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and Maintenance of Way

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VOL. II CHICAGO, DECEMBER, 1906 NO. 12


## *The Cross Tie of the Future*

IN OUR November issue was published an article on the "Practicability of Life of Metal Cross Ties for Railroad Track Construction" by the chief engineer of the Bessemer & Lake Erie, that we think deserves more than a passing glance. The necessity of a substitute in place of the ordinary wooden tie which is constantly growing scarcer, has assumed a proportion of more than an alarming rumor. To have one large system order an immense lot of ties from Japan is an almost convincing statement in proof. It seems to lie therefore between the concrete and the metal tie for supremacy. It is evident, beyond a doubt, that some improvement is necessary in the tie situation and the question is, in what direction is this improvement to be obtained?

## *The Value of Technical Journals*

AN INSTANCE of the value of technical papers was suggested in a remark recently made by a young man who was asked to advise a text book which treated comprehensively of a given subject. His reply was to the effect that while text books present opportunities for acquiring fundamental knowledge and principles, they fail to keep up with the times; they soon become back numbers. This deficiency in text books is supplied by the technical journals whose province it is to describe and illustrate the most recent designs and improvements as well as to invite and elicit discussion by eminent authorities concerning the relative merits of the latest achievements of engineering progress.

Journals devoted to specific departments of engineering or science thus form useful records of new and improved designs and original investigations which are made in the field covered by them. Such records are appreciated not only by those whose interest is purely technical or casual, but particularly by those who are contemplating improvements similar to those that are thus described and who, by taking advantage of the information so distributed, are enabled to avoid the discrepancies and mistakes of others and to give the proper values to methods which have been newly demonstrated to be practical and efficient by the tests of actual service.

## *Effect of Heavy Rolling Equipment*

THE present tendency to furnish greater transportation facilities without a corresponding increase in transportation expense, provides an exigency which must be met by the mechanical and engineering departments alike. The demand is for heavier motive power and for rolling stock of greater capacity as well as for more commodious terminal facilities and additional side tracks.

Reflection upon the recent orders of two prominent railroad companies for heavy locomotives of the Mallet articulated type for road service, as well as upon the work of a similar type of engine which has been in pushing service for some time, leads to the conclusion that the use of this class of power is beyond the experimental stage and that further development may be expected along this line.

There is a case on record of a railroad company disposing of a locomotive which it had ordered, because the engine, as built, was too heavy for the roadway and bridges. The continually increasing size and weight of locomotives would indicate that further developments may be looked for. This factor must necessarily be reckoned with by providing tracks and bridges capable of carrying not only the class of power now in service but also that which it is natural to anticipate during the next ten or fifteen years.

The fact that some companies are still purchasing locomotives of increasing weight, must influence other lines to prepare for the transportation of such power in transit, even though they do not contemplate the installation of such power on their own roads.

The effect of this constantly increasing weight and size of locomotives will soon be, if it is not already, felt on account of inadequate facilities for handling the larger parts during repair work. Longer turn tables of greater capacity will be required; longer roundhouse and repair shop pits will be needed, as well as cranes of greater capacity, and this necessarily directs attention to the

columns and girders to support the greater weights carried by the cranes.

These and many other features incident to provisions for increasing transportation facilties, tend to show that enlarging the capacity of one department must be accompanied by corresponding preparations in the other departments.

### *Success of the Roadmasters' and Maintenance of Way Association*

DELEGATES to the Roadmasters' and Maintenance of Way Association, as well as all others interested in the achievement of the organization, have every reason to congratulate themselves on the success of the convention held in Chicago during the past month, as evidenced by the attendance at all sessions and by the close attention to subjects under discussion.

The small attendance at the meeting held last year at Niagara Falls was naturally discouraging to those having the welfare of the association at heart, so that the marked contrast between the convention just ended and the previous one, shows a growing desire to further the interest of the association and maintain it among the healthy organizations which improve railroad service and develop facilities.

The selection of the fall of the year as the season in which to convene represents a move in the right direction and is without doubt partially responsible for the large gathering at the recent convention. November is the most likely month during which it is practical for a roadmaster to absent himself from the scene of his activity. The general acceptance of this fact is well in accord with the principles of good railroading and will induce greater co-operation of the managements in advancing the interests of the association.

The choice of Chicago as the meeting place in 1907 indicates a further appreciation of governing conditions. This city, while not the geographical center of the principal railroad systems, is an industrial center which the greatest railroad companies enter either by trunk lines or associated connecting lines, so that Chicago is a point to which transportation is available by the greater number of members wherever located.

### *The South and Western Railway*

IN THE mountains of Virginia, Tennessee and North Carolina, some difficult railroad construction has been going on for the last year or two. It has been carried on so quietly that very few persons except some financiers in New York and people living near the work, are familiar with the existence of a road known as the South and Western. The old road by that name has, however, operated in Tennessee for some ten years or more, and is about 70 miles in its entirety. While the former alignments and gradients remain, such changes are being made in the original road that the old South and Western will hardly be recognized as the same.

The true situation with regard to this road is as follows: Men interested in the Seaboard Air Line Railway are backing the South and Western. They have bought and are holding under an entirely separate company some 300,000 acres of rich coal property known as the Clinchfield Coal Lands, in southwestern Virginia. With a low grade line through the mountains intervening, they propose to carry this coal to the coast, possibly arriving at Wilmington, N. C., or Charleston, S. C., and also to feed the Seaboard Air Line which connects extensive north and south territories.

The most notable feature attending the construction of this road is the low grade through the mountains. While this appears very simple to the uninitiated, it means much to one familiar with the situation. Toward the south and in the direction that the heavy tonnage will be run, the maximum grade is a .5 per cent compensated. This means, that although there are naturally a good many curves, there are only a few that are as high as eight degrees and the largest part of the grade is only .3 per cent. An actual account shows that only about one-eighth the length of the line in a southbound direction reaches a .5 per cent grade. In northbound traffic 1.2 per cent compensated will be the ruling grade. As this will have mostly empty cars the situation is very nicely balanced.

To do this has required some very clever engineering skill, and as one of the officials of the road remarked, "other roads are normal in their construction; this road is abnormal."

The bridges to be put in should prove especially interesting to bridge men throughout the country. Bridges have been figured on what is known as Cooper's E-60 loading, from ten to twenty per cent heavier than ordinary. In fact the officials who first proposed this loading were laughed at and were thought to be throwing money away. Since the advent of heavy locomotives of the Mallet type the laughter has become faint and the farsightedness of the engineers has become apparent. An engine of this type would tax the bridges that are put on this line, to ninety per cent of their safe loading, so that the E-60 is none too large.

Again, the low grade of this line has caused the cutting of a good many tunnels varying from 200 feet to almost a mile in length. The heaviest or longest one is being cut through Clinch Mountain very close to the Virginia and Tennessee state line.

In addition to later developments and extensions to the coast, the road will rely mainly on its coal tonnage for its revenue. Within the limits of present operation there are no large towns on the line, with the exception of Johnson City, Tenn., which has a population of only 7,000, and any traffic other than the coal trade must be largely built up. The road must develop its own towns, build them up, bring the people in, encourage trading, etc.

Whatever the immediate outcome, the road must be a success eventually; for even if the present officials should fail, the immense advantages of a low grade line for heavy tonnage work is duly realized by many roads that would be only too glad to seize the opportunity presented by this one.

# Round House with Concrete Roof Construction

## Denver & Rio Grande R. R.

*(First Portion of an Article Describing This Round House.)*

THE Denver and Rio Grande Railroad has recently constructed a new round house at Pueblo, Colo., according to plans embodying several novel features. These are noticable particularly in the form of the sections of the houses, the construction of the roofs and buildings which are of concrete, the design of locomotive repair pits and the provision for overhead traveling crane and trolley hoists which serve the section in which are located drop pits for driving and truck wheels.

The house as a whole is built in three sections containing a total of 49 locomotive repair pits, or stalls, of which three are arranged for dropping driving wheels and five for dropping truck wheels. There are fifteen pits in the section containing the drop pits and this section is constructed to provide for the operation of an overhead traveling crane of 15 tons capacity in the outside bay.

The crane is operated by a 3 phase 60 cycle electric motor and runs on rails curved to the radii of the house, compensation for the difference in length being made by wheels of different sizes on the carriage. A single track trolley of 3,500 lbs. capacity serves each of the other two bays.

The entire roof construction is of reinforced concrete, including the crane girders. This is all monolythic, no joints being allowed except that at every third stall the roof is entirely separated from the adjoining portion by a ⅝ inch expansion joint crossing the roof laterally and covered with a strip of flexible composition roofing to keep out the weather. The roof slab is made water tight by one heavy coat of Elaterite paint. The entire roof is supported on steel columns and these columns are fireproofed with wire lath and cement plaster.

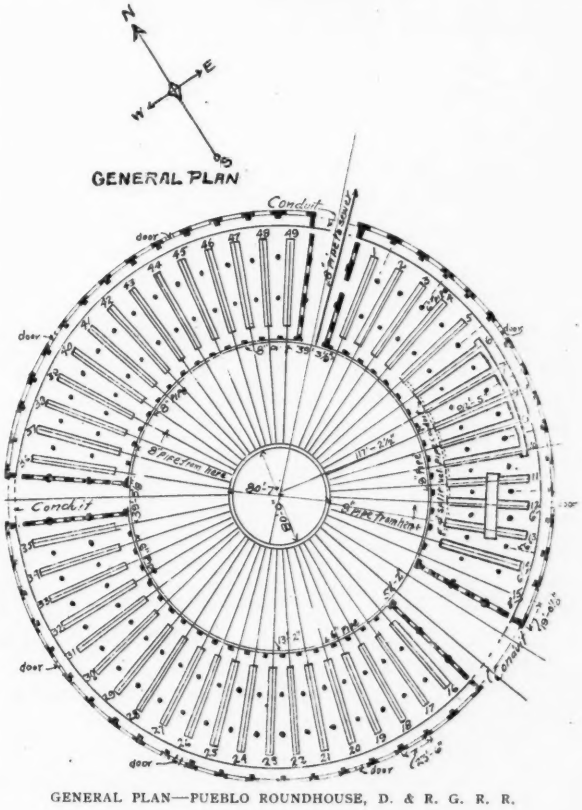
All sections of the house are divided into three bays separated by two rows of steel columns supporting the roof girders. In the crane served section the outside bay is higher than the other two bays to provide room for the movement of the traveling crane. The crane runways are carried on concrete girders supported by steel columns. The crane spans a distance of 30 feet. The height of this bay from base of rail to top of column is 25 feet and 11¾ inches. The distance from top of rail to bottom of crane is 30 feet, from bottom of crane to bottom of roof girder is 6 feet 6 inches, and from top of rail to bottom of roof girder is 36 feet 6 inches

A ventilator located in the center of the roof of this bay extends the full length of the section. The roof is of concrete slabs carried on concrete beams. These girders are supported by the outside wall and by the inside curtain wall reinforced by pilasters. The roof over the other two bays is of similar material carried on concrete beams.

These bays are lighted by skylights in the roof placed parallel with the repair stalls and occupying a position immediately above the floor space between the stalls in order to provide ample light on both sides of a locomotive when standing in the round house.

All skylights are made of wired glass laid in heavy rabbeted pine sash bars fastened directly on the concrete curb. The glass is raised above the curb at the ends ½ inch to allow clearance of smoke.

In order to provide for the movement of the crane, unobstructed by smoke jacks, the jacks are offset as shown in the plan and elevation of the high section of the house. Each jack is capable of a vertical adjustment of 4 feet and when at its bottom position, the lower edge of the flare of the jack is thirteen feet from the top of the rail.

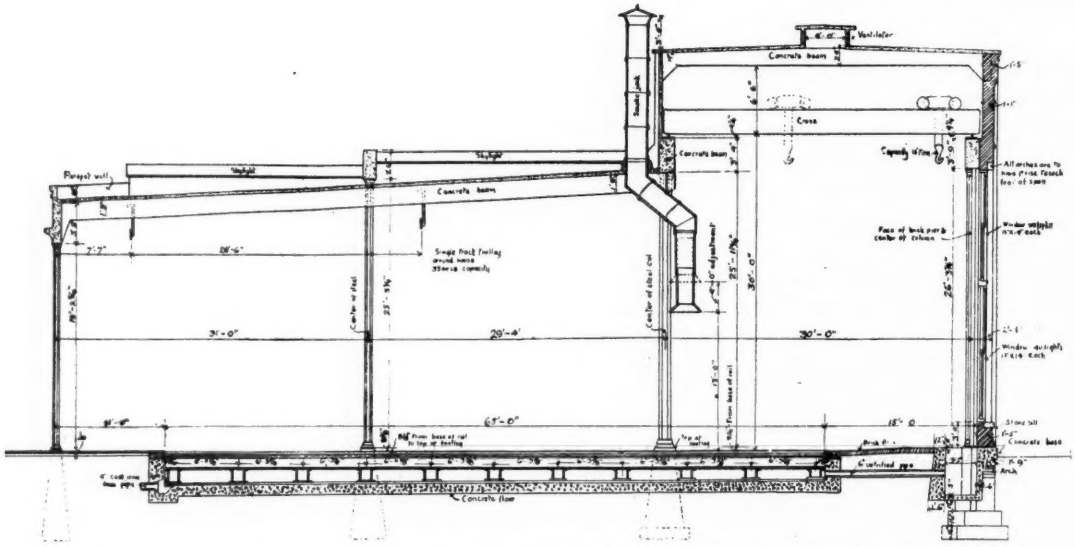



GENERAL PLAN—PUEBLO ROUNDHOUSE, D. & R. G. R. R.

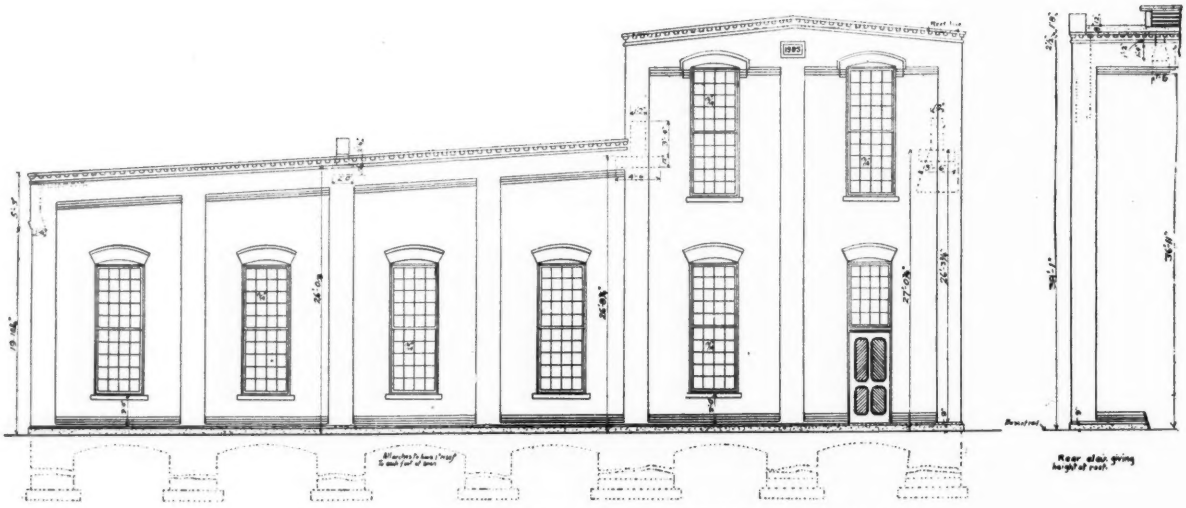
These are special cast iron Dickinson jacks with offset as shown for the high section and regular pattern for the low section.

In the two low sections the center bay is higher than the outside bays. The concrete roof slabs are carried on concrete beams suported at each end by concrete girders supported on steel columns. These columns are 6 inch channels braced together, arranged on 13 feet 2 inch centers, and all other columns in the round house are of the same construction.

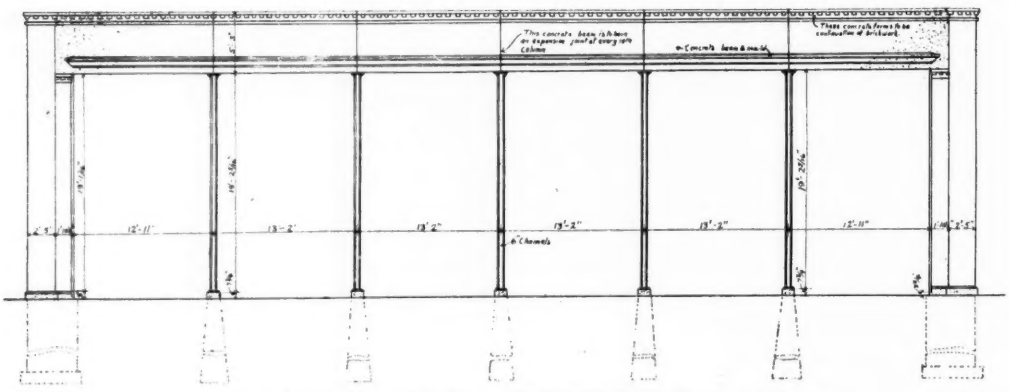
On the center of the roof of each of these bays, a venti-



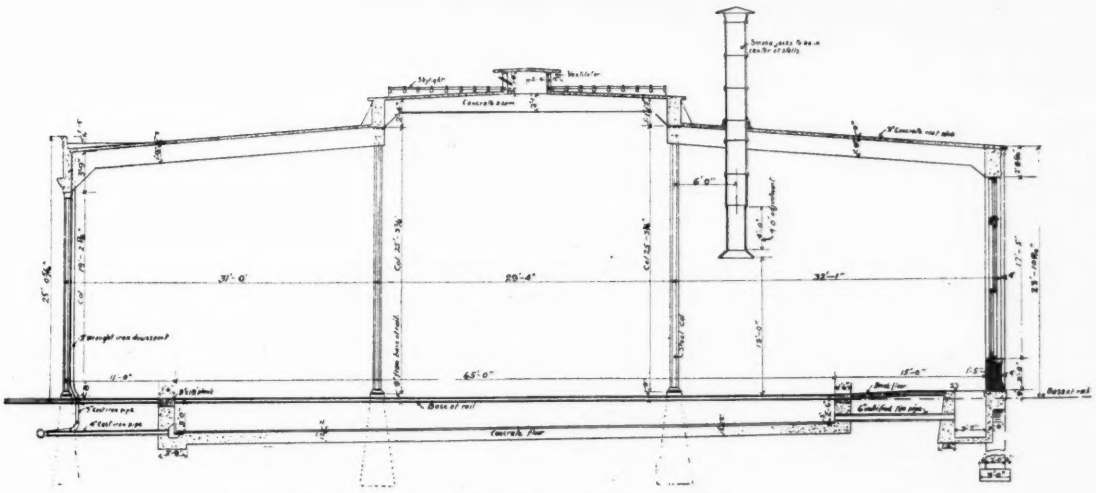
TRANSVERSE SECTION OF HIGH PORTION THROUGH CENTER LINE OF PIT—PUEBLO ROUNDHOUSE, D. & R. G. R. R



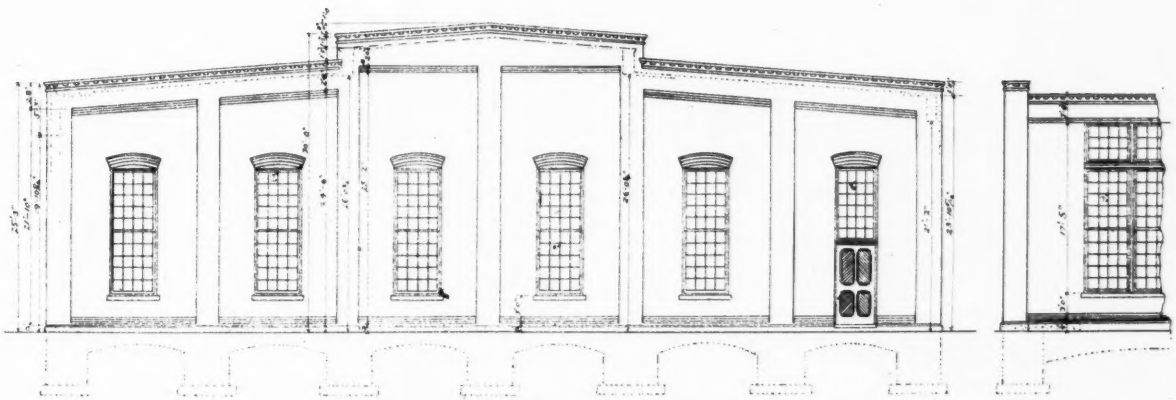
END ELEVATION OF HIGH PORTION—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



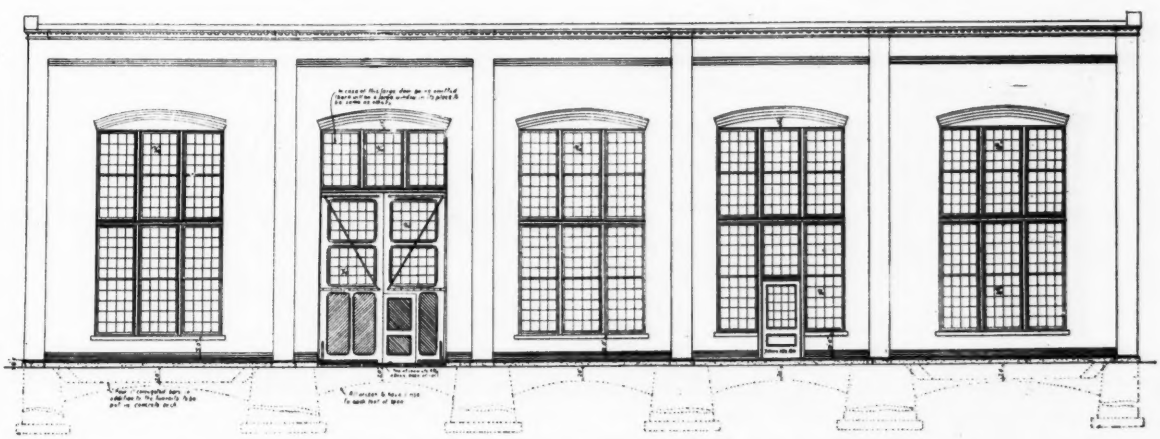
PART ELEVATION OF INNER WALL—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



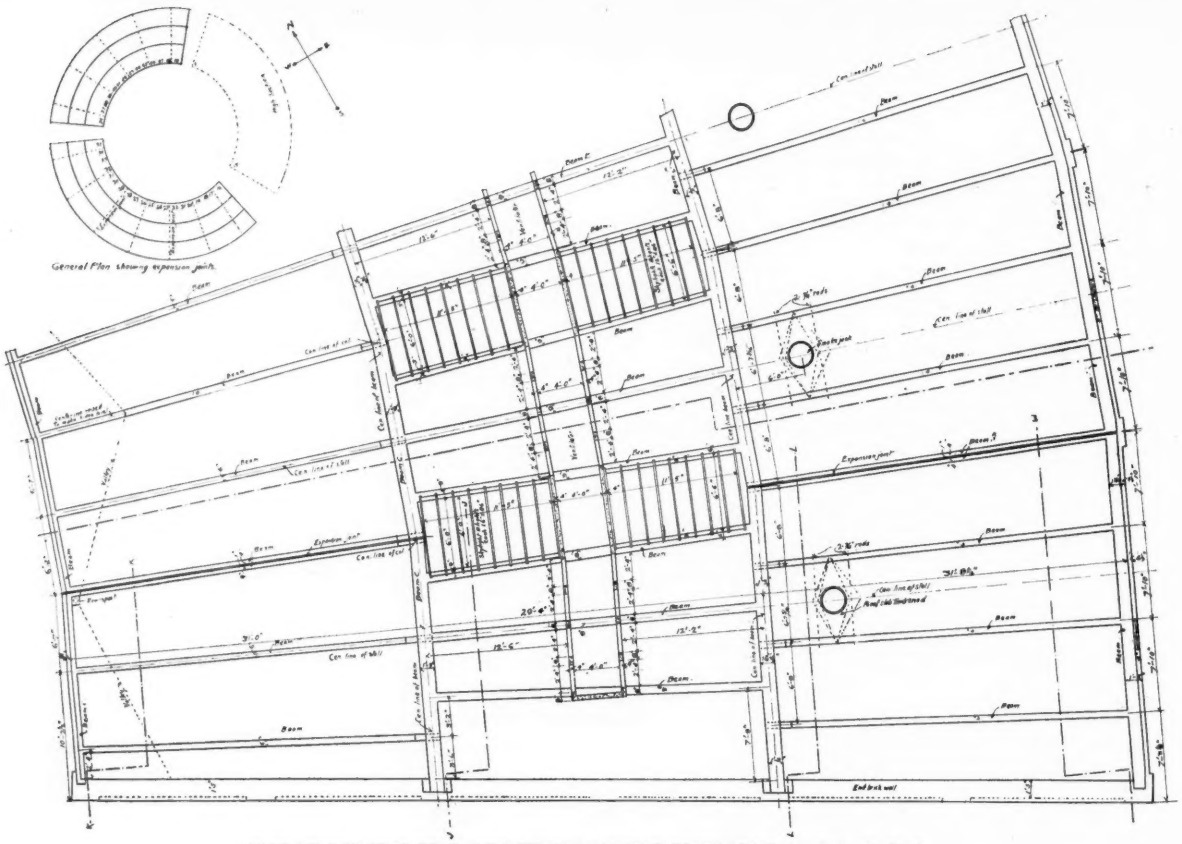
LONGITUDINAL SECTION OF LOW PORTION—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



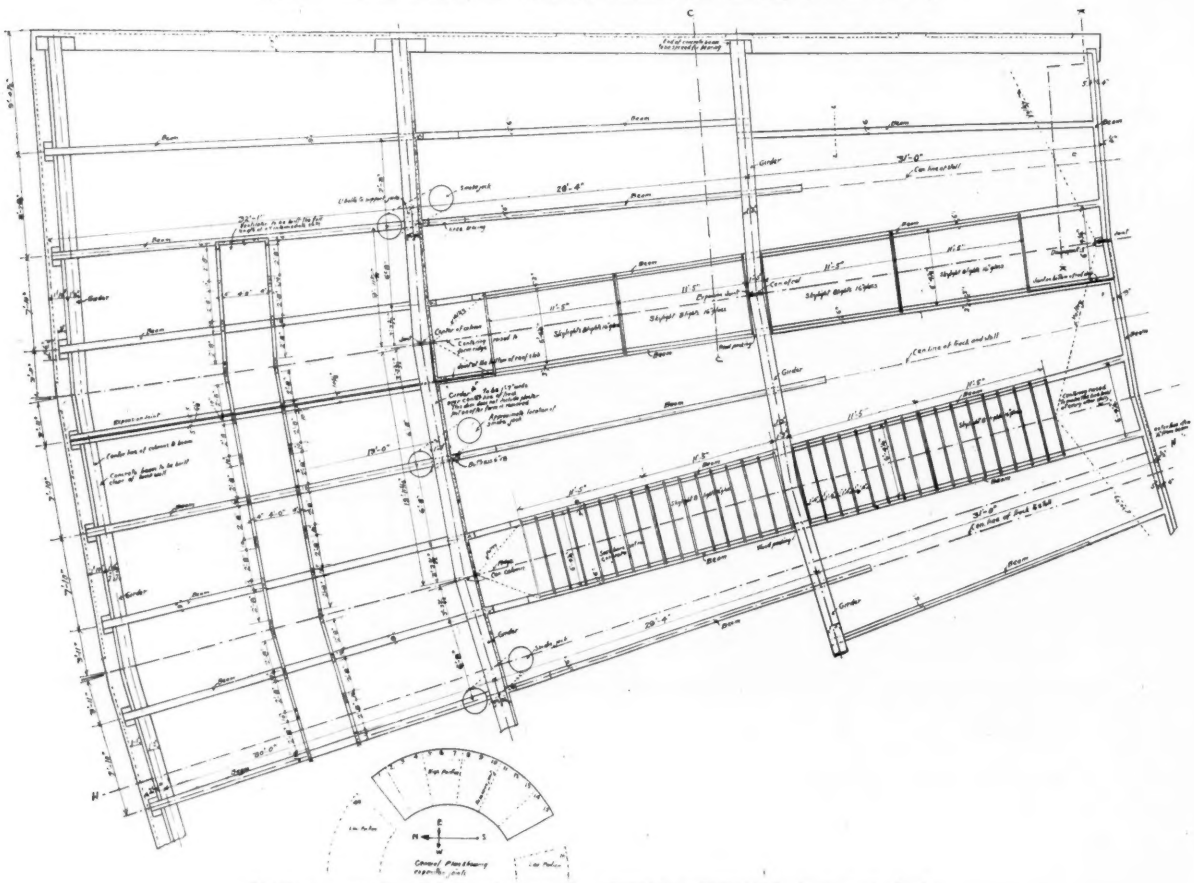
END ELEVATION OF LOW PORTION—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



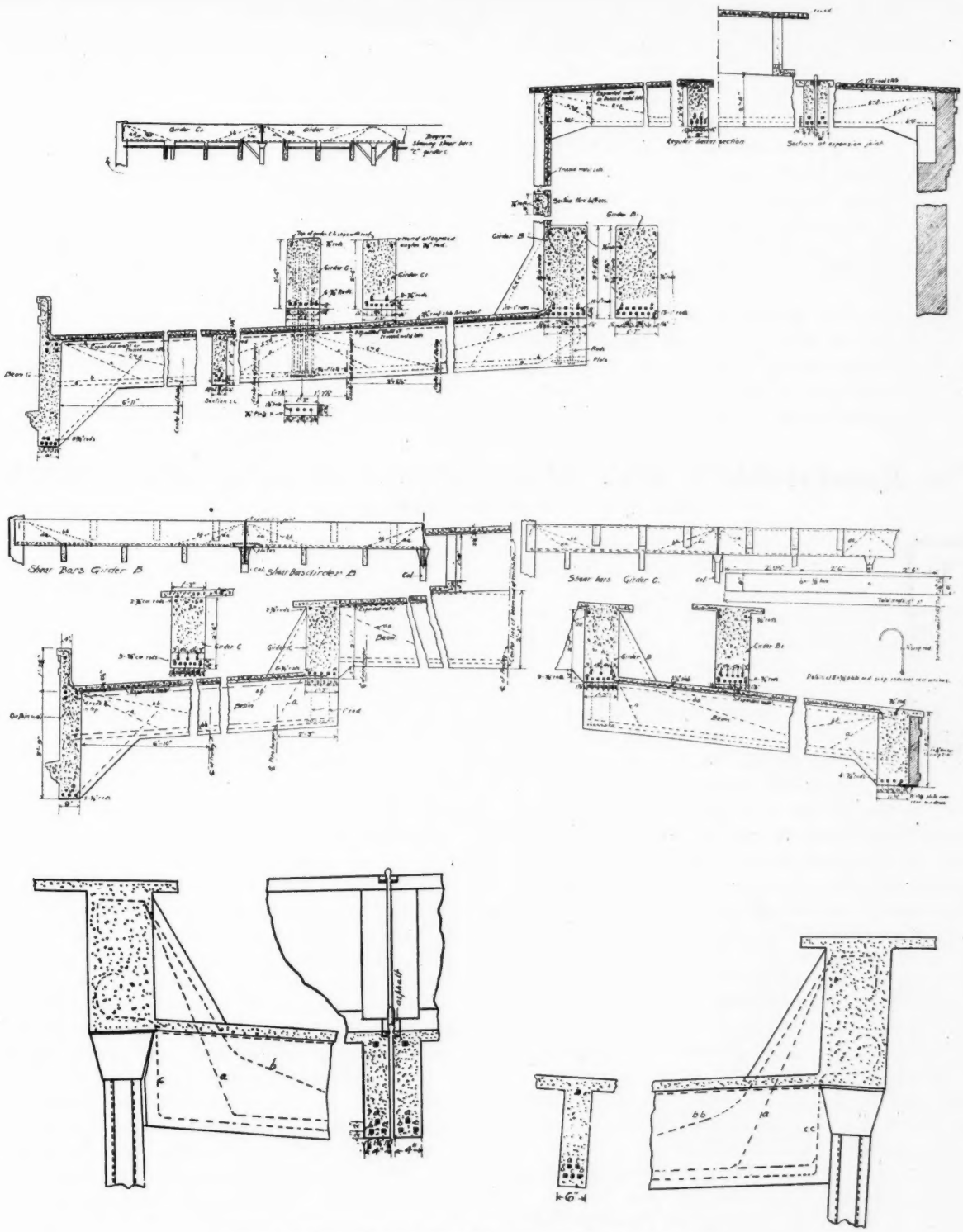
PART ELEVATION OF OUTER WALL—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



PLAN OF CONCRETE ROOF, LOW PORTION—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



PLAN OF CONCRETE ROOF, HIGH PORTION—PUEBLO ROUNDHOUSE, D. & R. G. R. R.




DETAILS OF CONCRETE ROOF—PUEBLO ROUNDHOUSE, D. & R. G. R. R.

lator with swinging side sashes extends the entire length of each section. Extending from the ventilator to the outer walls are a number of skylights arranged between the repair stalls. The roof girders of the outside bays are suspended at the inner end from the concrete beams suported by the columns and at the outer wall they are supported by concrete beams carried on the brick wall of the round house, and at the turn table end they are

supported by the curtain wall carried on the door columns.

In all sections this curtain wall is extended above the roof as a parapet wall to form a gutter for the purpose of collecting all drainage from that portion of the roof which drains toward the turn table and this drainage is delivered to the sewer system by 3 inch wrought iron down spouts inside of the house. This provision is made to provide against the undesirable feature of water dripping from the roof and freezing in winter weather, which would obstruct the movement of the round house doors. All other roofs extend beyond the supporting walls so as to form eaves.

Drainage from the roof and from pits is carried away by 6 inch to 8 inch cast iron soil pipes connected with 6 inch lateral pipes leading from the ends of the pits. Openings of the pipes at ends of pits are protected by angular cast iron gratings. The size of the drain is purposely small so that it will flush itself, and three catch basins are used in the circle.

The drain for the pits is carried just outside of the inside lines of columns and at the point of discharge is trapped through a man hole catch basin and discharged directly into an outfall sewer to the city main.

The turn table pit is drained separately to the same outfall through a cast iron grating over a cess pool and there is no connection with the roundhouse drain except that the deep portion of the drop pit is connected directly with the sewer to the turn table on account of the greater depth of the drop pit.

It will be noticed that the roof girders in the several bays of the low section are staggered while in the several bays of the high section they are continuous. In all sections the door columns of the inner circle are arranged on 13 feet 2 inch centers and the same distance obtains between centers of tracks measured along this line.

# The Roadmasters' and Maintenance of Way Association

## Twenty-Fourth Annual Convention.

THE twenty-fourth annual convention of the Roadmasters' and Maintenance of Way Association was held in Chicago, at the Sherman House, November 13, 14 and 15. The meetings were presided over by the president, Mr. C. Buhrer, of the Lake Shore.

The first session was opened by an address from Mayor Dunne, in which he extended a welcome to the members and their guests. After acknowledging the mayor's welcome, Mr. Buhrer delivered his presidential address. In his address he called attention to the importance of the roadmaster's work and emphasized the necessity for concerted effort on the part of the association members in advancing their interests and those of the roads which they represent.

The opening meeting was held on the morning of the 13th, and was devoted principally to the election of officers and other general business. An afternoon session was held during this meeting; the report of the committee on "The Best Method of Maintaining the Track for the Tonnage and Speed of To-day" was presented. The discussion of this report occupied the principal part of the first and second day's sessions.

The attendance at this afternon session was representative of the interest and enthusiasm of the convention, and the following sessions were nearly as well attended. There were about seventy-five members present during the convention and fifteen members were enrolled.

Credit is due in large measure to President Buhrer for the manner in which he enlivened the discussions and drew forth expressions on the various topics until the different subjects under consideration were thoroughly thrashed over.

The first report presented covered many of the principal features of a road master's work and was divided into nine sections or sub-headings. In discussing this report each section was considered separately, and each paragraph was presented individually and so discussed. While some of the recommendations of the committee were adopted without change, others were qualified or amended according to the vote of the convention. This report is presented elsewhere in this issue.

### FOUNDATION OF AN UP-TO-DATE RAILROAD.

In opening the discussion, attention was directed to the effect upon the track due to the heavier power and rolling equipment, as well as the faster trains of the present and the consequent additional expense for maintaining roadbed. In this connection Mr. C. H. Cornell (C. & N. W.) expressed the sentiment that it was necessary for road masters to express themselves more forcefully in order to get heavier material with which to keep up their work and he considered it the roadmaster's place to say what should be had in order to maintain track in proper condition. The ensuing discussion brought out the ideas that ten inches of stone ballast is a necessary foundation for a modern roadbed and that in many cases not sufficient ballast is being used; that where spots occur, good practice is to dig out and put in tile; and that it is necessary to make wide cuts and fills.

Some question arose as to whether such work as outlined in the report was necessary for roadmasters to pass judgment upon, as the original construction is usually done by the engineering department. It was maintained that inasmuch as it is the roadmaster's function to maintain track properly, he should have something to say with reference to the efficiency of the original construction, especially as it is his duty to report bad construction.

In discussing soft spots in track Mr. Boydston (A., T. & S. F.) expressed the opinion that it is impossible to dig a hole deep enough and to put enough rock in the hole when dug to prevent trouble with soft spots unless the place is properly drained first. The plan suggested by him

in this connection is to dig down and put in a roof and then drain by the use of drain tile and brick.

Attention was called to the necessity of making allowance for settlement and Mr. James M. Sweeney (C. & E. I.) approved of allowing a roadbed to settle for at least a year before putting down stone ballast. It was contended that ballast should be adjusted to take care of the settlement, and the stand was taken that there is no use to make fills higher than the base of the ties and attention was called to the fact that allowance for a settlement depends upon the kind of material in the fill.

### DRAINAGE OF ROADBED AND TRACK.

Much discussion centered upon the experience had with drain tile of short sections. Replying to a statement that with sections of drain tile one foot in length the joints frequently become separated on account of the drain humping up, Mr. Burke (C., M. & St. P.) said that it was his practice to put the tile below the frost line and lay it on boards, and reported that he had experienced no difficulty with drains laid in this manner.

As a result of the discussion on the porosity of tile, the consensus of opinion seemed to be that most water enters a drain through the joints rather than by soaking through material. It was said that good drainage is essential to a good track, and that where ditches may be had wide enough and deep enough no drain tile is needed. In cases where there is not much fall, it was said that mud closed up the tile, and attention was directed to the fact that water standing in the ditch is a pretty good sign that the tile is stopped up.

In discussing how far from the ballast line the tile drains should be laid, Mr. Thompson (A., T. & S. F.) explained that he instructed his men to put the tile four feet deep and lay it in a trough with three inches fall in 100 feet of length. The principal thing was to get it deep enough, and in his opinion the tile should be at least three or four feet below the line of ballast. The practice described by Mr. Houghton (L. S. & M. S.) is to lay drain tile two feet from the line of the end of the tie and three and one-half inches below the ballast.

### DEPTH AND KIND OF BALLAST.

In the discussion as to stone ballast there was an evident difference of opinion regarding the limits of size. Two inches was considered too large and one-fourth inch too small. Mr. Houghton advocated three-fourths inch as quite small enough, basing his argument on the fact that with smaller stone there would be too much dust in the ballast. Mr. Sweeney advocated the use of one inch mesh in determining the size of stone for ballast, and Mr. Shoultz (Monon) advised that he had obtained good results with unscreened stone. Mr. Brandt (C. & N. W.) called attention to the fact that large stone has a tendency to come to the top, and he explained his practice by saying that he puts stone of the larger size at the bottom and allows it to be run over for a week or ten days, after which he puts on a medium size and uses what screenings he has in the yards. He further explained that in raising track, the small stone will go to the bottom.

While some members spoke of having used unscreened stone, there were several expressions against its use because of a tendency to hold water and also to pack almost as hard as cement. It was recommended to use no smaller mesh than one-half inch, and this recommendation being put in the form of a motion, was carried.

### SIZE, LENGTH AND SPACING OF TIES.

It developed early in the discussion that the sentiment of the convention was in favor of the general adoption of a tie longer than that commonly looked upon as standard length. While the original report of the committee as presented, recommend a tie eight and one-half feet long, a recommendation was made in favor of a tie nine feet long, and this recommendation having been put in the form of a motion, the convention voted to place the association on record as being in favor of a tie seven inches by nine inches by nine feet in length.

Attention was called to the importance of placing ties in line with the centre of the track regardless of slight variations in length. Some allowance to provide for a difference in length of ties was looked upon as necessary in view of the seeming independence on the part of tie producers in providing ties of equal length. President Buhrer insisted upon the necessity of having ties of uniform length, not ony for the sake of appearance, but also for the purpose of equalizing the bearing. He objected to short ties being put in the track with those of greater length and expressed the opinion that they should be separated carefully and all short ties used in side track. Mr. J. W. Guffey (A. T. & S. F.) said that the statement of a member that he had experienced difficulty with ties breaking under the rail, appeared to him as an argument in favor of thicker ties.

### WEIGHT, HEIGHT AND PATTERN OF RAIL.

In the discussion on rails there was evident a very ardent desire to effect an improvement in the service of rails. To attain this end the sentiments expressed seemed to be in favor of a lower rail, with a wider base, and allowing two inches in height for the ball of the rail. Attention was called to the fact that with a two-inch ball it is impossible to get sufficient metal in the angle bars below the head to make joints of sufficient strength, as a certain amount of height of web is necessary to secure proper fastenings. A further consideration necessary in the determination of the proper proportioning of rails, of which mention was made, is the problem of manufacture and the effect on cooling imposed by the form and design of the rail.

In referring to the height of web necessary to secure proper fastenings, mention was made that even now flanges of wheels soon cut out angle bars sometimes after only six months' service.

### RENEWING TIES IN DIFFERENT KINDS OF BALLAST.

In the discussion of renewals, Mr. McCurdy (C. St. P. M. & O.) expressed the opinion that the best practice is to avoid patch work renewals. Where possible all ties on a certain length of the section should be renewed each year, the renewals on the remainder of the section being limited to such individual ties as absolutely required

to be taken out. Such practice was not considered favorably by other members and was looked upon as unpracticable owing to varying life of ties and to the fact that the track would not be in first class condition where only a few renewals had been made.

Mr. J. Kennedy (B. & O.) maintained the position that it is impossible to put a new tie in the old bed, because an old tie has been so cut down in service that a new one would be thicker, and if it was placed upon the old bed it would raise the rail out of surface. Under such circumstances it was considered that the whole track should have a slight raise.

Where there are six or eight ties to the rail to be renewed Mr. Guffey considered it cheaper to raise the track out of surface than to dig out the old ties. Digging below the bed of the tie, even between ties was opposed by Mr. Clough (N. Y. C. & H. R.).

PROPER METHOD OF SURFACING OR TAMPING TRACK.

In discussing methods of tamping, objections were raised to excessive tamping as destroying the ballast, and a speaker favored greater use of the level as oscillations of locomotives passing over the track are due to its being unlevel. Also, objection was raised to the use of the tamping bar if it was necessary to use the tamping pick afterward, as the use of both tools was looked upon as a waste of labor. The clause in the committee's report referring to the use of the two tools was struck out and the section adopted as read, with this modification.

PROPER METHOD OF LINING AND FILLING TRACK.

The remarks made upon this section of the report evidenced a decided opposition to the recommendation of the committee that ballast should be sloped down from a point under the rail, the opinion being that under modern conditions it is necessary to fill in level with the top of the tie and form a shoulder to hold the track in line. In this connection Mr. W. E. Emery (C. & N. W.) expressed a preference for ballast extending four feet from the rails, basing his views upon the requirements of heavy traffic. After considerable discussion it was voted to qualify the recommendation made by the committee in its report.

ADJUSTMENT OF CURVES WITH CONSIDERATION AS TO EASEMENT.

There was very little discussion consequent upon the presentation of this section of the report and with slight amendment it was passed as read.

MAINTENANCE OF TRACK IN TUNNELS.

A paper on "The Construction and Maintenance of Track in Tunnels" was read by Mr. E. E. R.Tratman, resident editor of the Engineering News. Mr. Tratman's paper was compiled largely from data recently published in that journal.

TIE PLATES.

The report of the committee on this subject described some of the more common forms of tie plates now on the market and covered to some extent the history of tie plates.

Owing to the fact that the various makes of tie plates are patented articles in the open market, the members were unwilling to express themselves freely with regard to them, or to go on record as favoring any particular product. Some members advocated the use of a rail with a base of such width that no tie plates would be necessary, and while this was looked upon as affording some assistance toward keeping the track in place, it would not prevent spreading, unless the track was in perfect line and gauge.

ELECTION OF OFFICERS.

Upon the close of the discussion of this subject, officers were elected for the ensuing year. The ballot for the election resulted as follows:

President, C. H. Cornell, C. & N. W; first vice-president, J. W. Guffey, A. T. & S. F.; second vice-president, John Kennedy, B & O.; secretary and treasurer, W. E. Emery, C. & N. W.

Member of executive committee, A. E. Hanson, C. & N. W.

Standing committee on new and improved appliances: C. E. Jones, C. B. & Q.; James Sweeney, C. & E. I.

NEXT PLACE OF MEETING.

Both Chicago and New Orleans were considered for the next place of meeting. In view of the many natural advantages presented by Chicago, the principal one being its accessibility to the majority of members, this city was selected for the convention in 1907. The opening session will be held on the second Tuesday in November.

AVAILABLE MEN FOR TRACK SERVICE.

Following the election of officers a topical discussion was held considering the inducement for young men to enter track service and remain a sufficient length of time to become foremen.

The trials of the road master, consequent upon the difficulty of securing competent men for track service, were clearly evident in this discussion. The nature of the work requires greater skill and intelligence than that which is usually manifest among laboring gangs on track work and it was clearly demonstrated that unless wages are paid commensurate with such requirements, little relief may be looked for. There is already great difficulty in finding capable men and a serious feature of the situation is the lack of material from which to make foremen.

A striking feature of this convention was the introduction of an innovation by inviting the supply men to appear before the meeting in order to describe the principles, operation and construction of their appliances, each one being allowed the privilege of the floor for five minutes in which to describe his specialty.

On Thursday morning the members of the association and their guests visited the South Chicago works of the Illinois Steel Company.

AMONG THE SUPPLY MEN.

The following were among the companies represented at the convention:

American Steel & Wire Company, Chicago. Railway right of way fence.—J. M. Holloway.

American Trackbarrow Company, Lowell, Mass.

Model of trackbarrow, pony car and timber track truck.—C. L. Pierce.

American Valve & Meter Co., Cincinnati, O. Switchstands.—F. C. Anderson and F. M. Foster.

Atlas Railway Supply Company, Chicago. Atlas rail joints, braces, tie plates and switchstands.—Daniel Thompson and G. M. Huber.

B. B. Fence Company, Peru, Ind. Fence stays and fence posts.—Edward Hoernel.

Belle City Malleable Iron Company, Racine, Wis. L. & S. anti-rail creepers, joint tie holders, and the Murray tie spacing and straightening jacks.—T. W. Harvey, Jr., and J. H. Dwight.

Buda Foundry & Manufacturing Company, Chicago. Ramapo switchstands, handcar, track levels and gauges, semaphore stands, jacks, drills and a special track lining jack.—Wm. Welsh, H. L. Shephard, R. M. Smith, John J. Gard, Wm. P. Hunt, Jr., A. W. Whiteford, H. R. Taylor, R. L. Hyland, J. T. Harrahan, Jr., A. E. McLeod and E. S. Nethercut.

Buhrer, C., Sandusky, O. Two Buhrer new improved I-beam type steel ties with wooden cushion and insulation blocks.—C. Buhrer.

Chicago Steel Tape Company, Chicago. Tapes, leveling rods, lining poles, etc.—L. A. Nichols.

Cleveland Frog & Crossing Company, Cleveland, O. Prentice anti-rail creeper.—Geo. Stanton.

Cook's Railway Appliance Company, Kalamazoo, Mich. Jacks, tool grinders, track drills, cattle guards, etc.—Eugene E. Cook.

Dilworth, Porter & Co., Pittsburg, Pa.—C. Stein.

Dressel Railway Lamp Works, New York. Switch and signal lamps.—J. M. Brown.

Dunn, Louis, St. Paul, Minn. Dunn's frog and switch indicator and blueprints showing the Dunn safety and the Dunn-Strawhorn switch adjuster.—Louis Dunn and N. McFetridge.

Fairbanks, Morse & Co., Chicago. Jacks, gasoline section car, velocipede car and track supplies.—T. M. Orr, C. W. Kelly, A. A. Taylor and J. H. Harden.

Grip Nut Company, Chicago. Sample line of grip nuts.—B. F. Stewart, R. S. Wickersham, W. T. Hibbard and E. Hibbard.

Hayes Track Appliance Company, Geneva, N. Y. Lifting and pivot derails, operating and target stands.—S. W. Hayes and S. H. Mansfield.

Hussey Binns Shovel Company, Pittsburg, Pa. Shovels, spades, and scoops.—J. H. Martin.

Jordan, O. F., Chicago. Model of ballast spreader.—O. F. Jordan and W. E. Amburg.

Kalamazoo Railway Supply Company, Kalamazoo, Mich. Hand and velocipede cars, track drills, gauges, levels, jacks, wheels, axles, etc.—John McKinnon, J. W. Thorn, D. A. Moore.

Locomotive Appliance Company, Chicago. Smith derailing switches, Freeland automatic derailing switches, Newton wrecking frogs and the Newton divided frogs.—W. H. England.

Luther Bros. Company, North Milwaukee, Wis. Grinding machines.—C. J. Luther and O. C. Luther.

Marshall & Dunn, St. Johns, Mich. Model of boltless rail joint—Geo. H. Marshall.

McCord & Company, Chicago and New York. Model of Gibraltar bumping post.—C. L. Brackett.

McMyler Manufacturing Company, Cleveland, O. Odenkirk switchstand and Economy separable switch points and lock cranes.—W. S. Newhall.

National Lock Washer Company, Newark, N. J. Nut locks and samples of their efficiency.—J. B. Seymour and F. B. Buss.

Pennsylvania Steel Company, Steelton, Pa. New Era and New Century switchstands, semaphore switch stands with disappearing blade. Manard frogs and track material.—R. E. Belknap, H. E. McCormick, N. E. Salsich.

Quincy, Manchester, Sargent Company, Chicago. Bonzano rail joint, Q. & C. rail archor, elastic nut lock, Caffarty tie tongs.—S. J. Collins, B. T. Lewis and G. T. Briggs.

Rail Joint Company, New York Samples of Continuous, Weber and Wolhaupter standard joints. Insulated joints and step joints.—D. J. Evans, W. E. Clark, V. C. Armstrong, F. A. Poor, E. L. Van Dresser, G. M. Hager, P. J. Dalton and B. Wolhaupter.

Railroad Supply Company, Chicago. Tie plates and railroad supplies.—E. H. Bell, M. J. Comerford and C. P. Cogswell, Jr.

Railway Specialty & Supply Company, Chicago. Anti-creeper and the Smith improved lock nut.—J. M. Brown, P. W. Moore.

Ramapo Iron Works, Hilburn, N. Y. Split switch and switchstands.—Arthur Gemunder.

Ryerson, Joseph T. & Son, Chicago. Working model of the Ryerson flue-cleaning machine, Simplex track and car jacks.—H. K. Boice, E. T. Hendee, H. T. Bradley.

Van Wormer & Moudy, West Unity, O. Loose pin nut lock.—B. A. Van Wormer and G. W. Moudy .

Verona Tool Works, Pittsburg, Pa.—W. D. Hechler, O. Metcalf, Jr.

Western Association of Inventors and Patent Development Company, Corona, Cal. Model showing method of railroad construction with ties parallel with rails and literature describing same.

Wilson, A. J., Chicago. Nut locks.—A. J. Wilson.

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The railroad companies have perhaps never paid so much attention to the safeguarding of their tracks as they are doing at the present time, and a late important contract for the installation of the automatic block signal has been placed by the Boston & Maine R. R., with the Union Switch & Signal Co. This contract calls for all material necessary to cover the equipment of the automatic block signal over at least 1,000 miles of track. The work involves an expenditure of several hundred thousand dollars and is one of the largest single contracts for automatic block signaling that has ever been placed by any company.

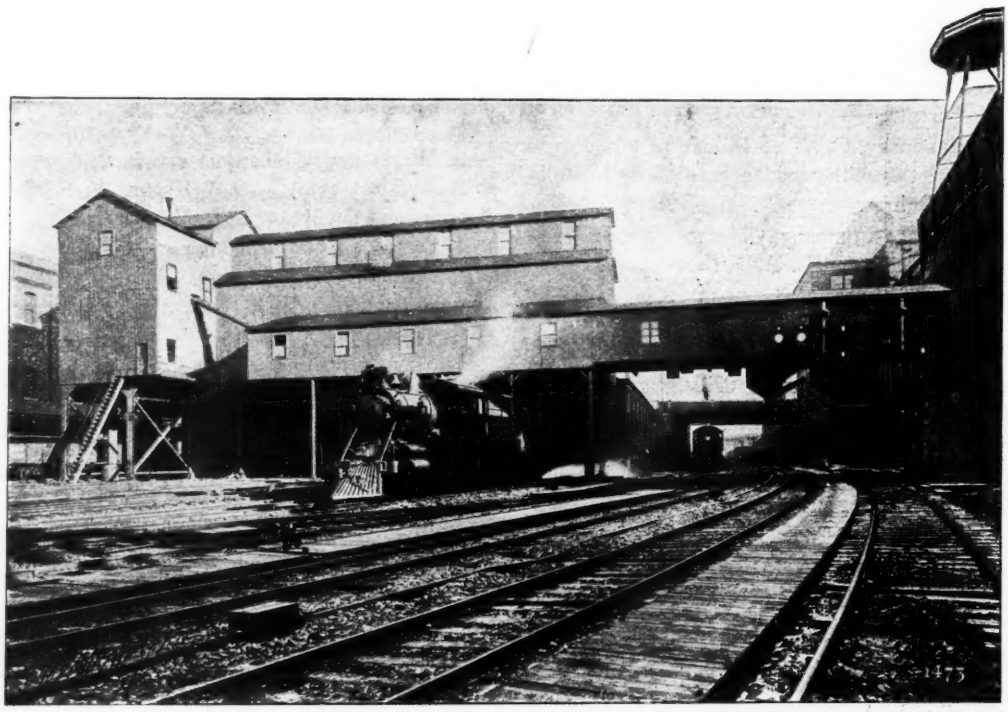
# Modern Railway Coal Chutes

V.

THE conditions that should govern the installation of a coaling plant are: The number of engines to be coaled, the kind of coal, whether it requires mixing or not and the amount of coal to be supplied during "rush hours." We say "should govern" because there is always the tendency to disregard improvements that have a high initial cost. In the long run this conservative policy if too closely held to, generally results in the deterioration of the road's efficiency. Several incidents may bring out the point more clearly. On one of the northern roads, trouble was had with the freezing of coal in pockets and in cars to be dumped. The plant itself was fairly well equipped. For several years the division officers were unable to obtain authority to spend about $500 to run the necessary steam-pipe lines, although ample boiler capacity for generating steam was close at hand.

Each year for about three months, from 20 to 25 men were used in the day time and 10 to 15 men at night. About $2,500 was wasted each winter because $500 was not spent to save it. The actual loss was greater on account of the waste of time in engines not being coaled properly.

Again, a small terminal coaled from six to eight engines a day. The arrangeemnt was a flat board platform at about the height of a car floor, the intention being to shovel coal from the car to the platform and from the platform to the tender of the engine. In cold weather and at other times though, the arrangement was found to have its defects. The cars used to bring in the coal were 80,000 lbs to 100,000 lbs. capacity, on which the sides were so high that after the top layer had been removed, the remainder had to be dumped through the bottom of the car to the track and then shoveled up on the platform. Snow, rain and freezing also caused trouble. Five to fifteen laborers were required to handle the work. Division officers prepared plans for a coaling plant requiring only two laborers and not exceeding three in the coldest weather. By taking advantage of a favorable contour, the cost would not exceed $4,500. They did not succeed in getting the appropriation.



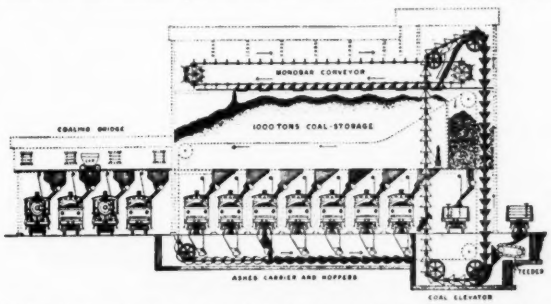
LOCOMOTIVE COALING AND CINDER STATION OF PHILADELPHIA & READING RY. AT PENNSYLVANIA AVE., SUBWAY, PHILADELPHIA. STORAGE CAPACITY 1000 TONS. COAL IS DELIVERED TO LOCOMOTIVES ON YARD TRACKS BY CHUTES FROM POCKET, AND ON THROUGH TRACKS FROM OVERHEAD BRIDGE. TWELVE ENGINES CAN BE COALED SIMULTANEOUSLY WHILE SEVEN OF THESE ARE DUMPING CINDERS.

At one of the conventions of the Association of Railway Superintendents of Bridges and Buildings, the cost of handling coal by various methods was given as follows:

| | Method of Handling | Cost, cts. per ton. |
|---|---|---|
| 1. | Shoveling from railroad cars to tenders.. | 25 |
| 2. | Shoveling from cars to high platforms and again shoveled on to tenders..... | 25 to 50 |
| 3. | Crane and bucket from storage platform | 35 |
| 4. | Shoveling from cars into bins from elevated trestle ..... | 10 |
| 5. | Dumping from railroad car directly into bins. ..... | 1½ to 3 |
| 6. | Hauling railroad cars by cable up steep incline and dumping directly into bins.. | 3 |

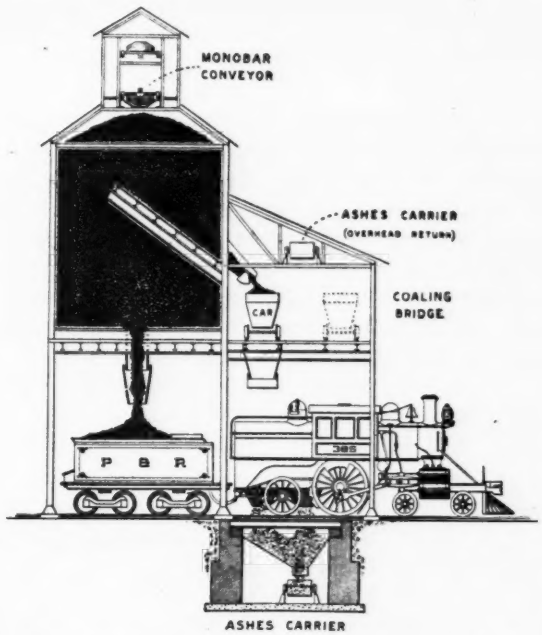
7. Dumping from railroad cars into pit and elevating by conveyors ..... 3
8. The same as above, but elevating by air hoist. ..... 5 to 10
9. Locomotive crane working from stock pile to bins or to tenders ..... 1¾
10. Dumping through trestle to platform and tramming and dumping into tenders.. 10 to 15
11. Dumping into pit in track and elevating skip by switch rope by engine taking coal. ..... 5 to 10

The point brought up as to the kind of coal used is almost a sectional point as the eastern roads are prob-



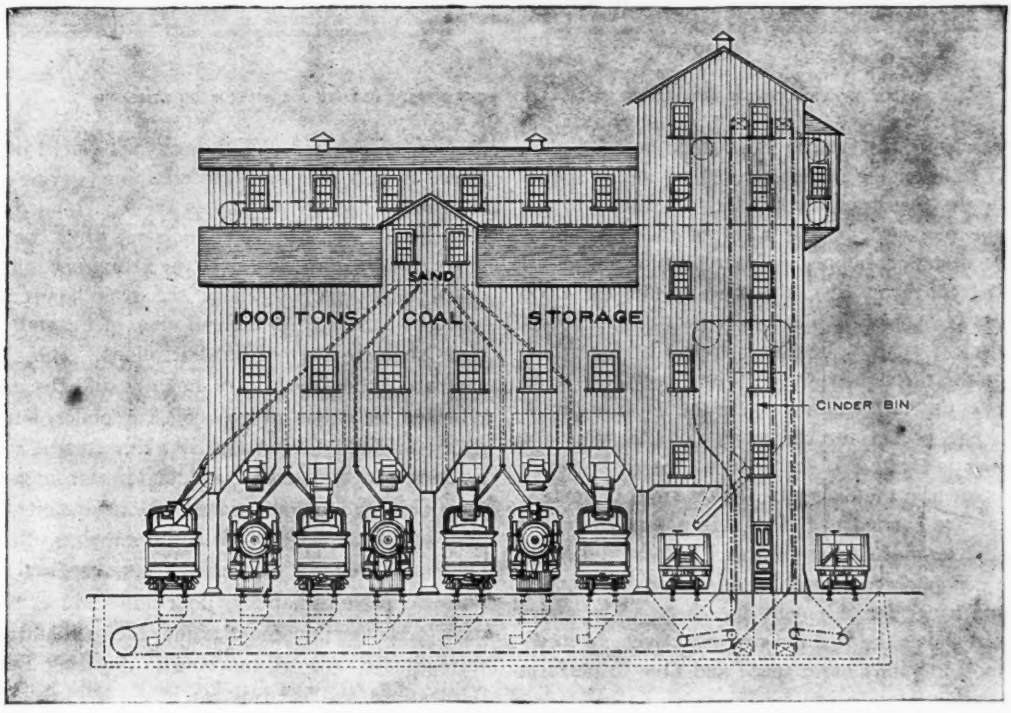

LOCOMOTIVE COALING AND CINDER STATION OF PHIL. & READING RY. AT PHILADELPHIA, PA. VIEW SHOWS ELEVEN ENGINES TAKING COAL, SEVEN OF WHICH ARE DUMPING ASHES; A CAR TAKING ASHES FROM ASHES POCKET AND A CAR DELIVERING COAL TO ELEVATOR, WHICH IN TURN IS DELIVERING TO OVERHEAD DISTRIBUTING CONVEYOR.

ably the only ones using anthracite coal to any extent. Even there the hard coal is very rarely used exclusively, but is mixed with bituminous. The important fast passenger engines may use the straight hard "lump" with the "broken" or "egg" on less important trains, while the freights get a mixture of small anthracite and bituminous.




LOCOMOTIVE COALING AND CINDER STATION OF PHILADELPHIA & READING RY. AT PHILADELPHIA, PA. THIS VIEW SHOWS AN ENGINE TAKING COAL AND DUMPING ASHES SIMULTANEOUSLY; ALSO METHOD OF DELIVERY OF COAL TO CAR ON RBIDGE

The tendency of the present day seems also to combine a sand and cinder storage arrangement together with the coaling station itself. Some good examples of this and also of the high degree of perfection that mechanical plants have attained are the coaling plants of the Philadelphia and Reading Ry., at Pennsylvania Avenue Subway, Philadelphia and the Terminal Railroad Association at St. Louis.




SIDE ELEVATION OF COALING STATION FOR THE TERMINAL RAILROAD ASSOCIATION OF ST. LOUIS

The Philadelphia and Reading coaling station delivers coal to yard locomotives by direct chutes from storage pockets while through service tracks are supplied by an overhead bridge.

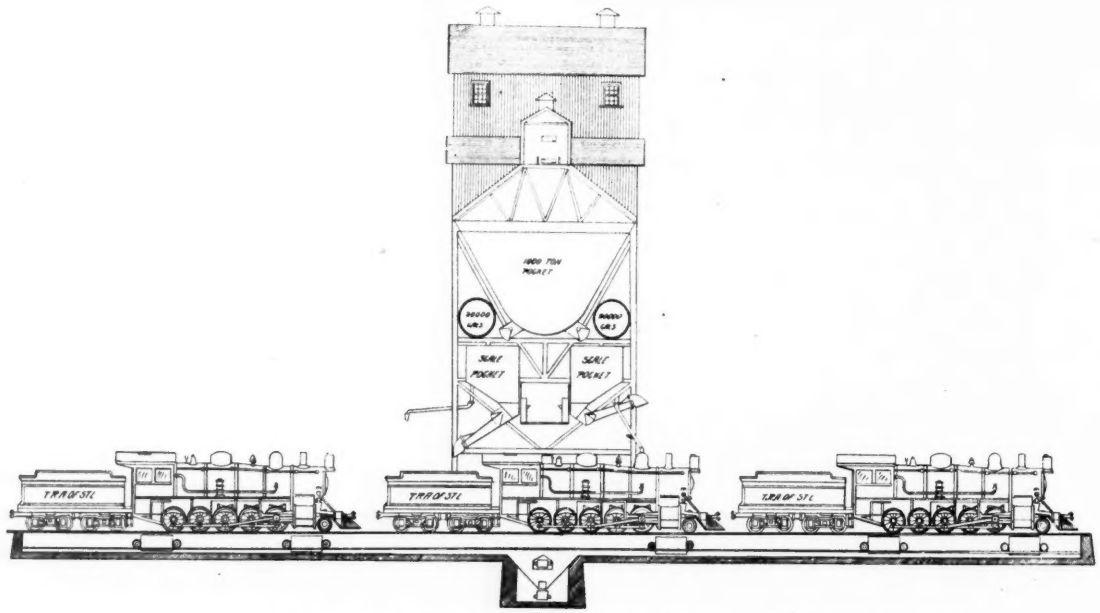
Twelve engines can be coaled at the same time and an additional set of carriers provide for the ash dumping of seven of these engines while they are being coaled. This arrangment is only provided underneath the coaling points of the yard engines as it is not needed for through service work. What is known as the "Monobar" conveyor system is in use for the coal handling work. The cinder arrangement in connection is a most ingenious one and peculiarly adapted to this place.

An exceptional scheme had to be devised for the place due to the congestion of the traffic, both main line and yard service. By noting the illustration a locomotive will be noticed as just starting out after being coaled. A through train engine is just coming up and will coal underneath the overhead track which is shown to the right of the picture. To the right of the diagram is located the dumping hopper. From here by means of the monobar conveyor, coal is carried up into the 1,000 ton coal storage pockets. The upper part of the pocket feeds to the car running on the overhead bridge which is used for the through engines. The lower half being of course for the yard engines where the chute is direct.

The storage pocket for the ashes dumped from the yard engines is located to the right of the coal storage pocket as shown in the diagram. Ashes from the dumping hoppers are carried to the storage pocket by means of the "shes" style of carrier. A track is located directly under the ash pocket so that the ashes can be dropped directly into a car for shipment elsewhere. The entire arrangement shows the vast improvement over old methods that took infinitely more space and time to perform the same work.

The coaling station installed for the Terminal Railroad Association of St. Louis was also constructed to supply a demand for quick and heavy coaling service. Here the coal storage pocket is again of 1,000 tons capacity, but in a different shape from that of the P. & R. Ry. This large pocket is tributary to thirteen auxiliary pockets, each having a capacity of 15 tons and mounted on registering beam scales.

A double system of carriers capable of receiving 2,000 tons in ten hours keeps the storage pockets sufficiently full. With this double system it is possible to receive coal on two tracks which is of course quite an advantage over a good many of even the latest mechanical plants. There is also a series of receiving hoppers for cinders dumped from the engines. An independent carrier elevates the cinders to another pocket from which they are discharged directly into cars placed underneath. There is also provision for elevating, drying and storing sand. The delivery tubes are so arranged of course that the engine can receive the sand while coaling. Engines can also take water at the same time. Two cylindrical tanks, located above the scale hoppers will be noted by reference to the end view of the station. Each tank has a capacity of 20,000 gallons. The coal supply cars are drawn over track hoppers and the empty cars removed by means of a double car puller, having a capacity of eight loaded cars. At this station seven locomotives can take coal, sand and water and discharge their cinders simultaneously. The cinder pits have been built to accommodate three engines each, so that twenty-one engines can be cleaned at the same time. This station is capable of handling four hundred locomotives per day. Above the foundations the structure is steel throughout. We are indebted to the Link Belt Co. for illustrations and information.



END ELEVATION OF LOCOMOTIVE COALING STATION—TERMINAL RAILROAD ASSOCIATION OF ST. LOUIS

# Maintaining Track for the Tonnage and Speed of Today

*Report of committee presented before the annual convention of the Roadmasters' and Maintenance of Way Association.*

FOUNDATION OF AN UP-TO-DATE RAILROAD.

OUR committee would recommend that more care be taken to prepare the foundation for roadbeds. Material of soundest, and hardest character or quality should be used, such as stone, natural soil, hard clay, slate, gravel, sand or cinders. Muggy spongy water holding clay or quicksand, should not be used. Where roadbeds are built on soft water holding clay or quicksand, not less than three to four feet of sound, solid material should be placed on top of it. In soft cuts, containing spongy clay or quicksand the grading should be done low enough to allow at least three or our feet of good ballast under the ties.

Foundations for track should be built so that every rain storm will not effect the surface and line of the track. This committee has observed cases where good surface, which took months of hard work and large sums of money to prepare, was destroyed during heavy rain storms. This result could have been avoided on a permanent roadbed. It would justify the first cost of building a permanent roadbed, as the expense of continually surfacing up low and uneven places is high; and besides uneven track is very annoying to high speed trains, and is also dangerous. Where the tracks are laid close to spongy clay, and close to quicksand, if the grade will not permit of raising the track high enough, sufficient depth of material should be dug out at these places, and supplied with three to four feet of good clean stone ballast. In this way continuous settlement, and uneven track, can be avoided at these points.

Permanent roadbeds shoud be built twenty to twenty-two feet wide, for single tracks, and thirty-four to thirty-five feet wide for double track, on high fills, and the same width in cuts to make room for good surface side ditches. The wide banks on high fills will repay for themselves by being broad enough to keep ballast and ties from going down the slope while unloading. The time spent from year to year in getting up ties, ballast and rails that have rolled down high banks is expensive, and it would more than justify the building of wide banks for roadbeds on high fills. The slopes on embankments, earth, should be built one and one-half to one, rock from one to one and one-half to one. In excavation earth should stand one and one-half to one, to three to one, loose rock one-half to one: solid rock one-quarter to one within the limits stated. These ratios may be varied as existing conditions demand.

DRAINAGE OF ROADBED AND TRACK.

To have good permanent track it is absolutely necessary to have good drainage. All track and roadbed should be kept free from water. No water should be allowed to remain on roadbed or tracks. Drainage should be provided by open surface ditches and tile drains, as the existing conditions will permit and demand. This committee would recommend that more tile drain ditches be laid, but nothing smaller than four inch drain tile shoud be laid in them; larger drain tile is preferable for the roadbed and track drainage.

On roadbeds built on soft-water-holding material, cross drains should be provided to keep the roadbed dry. Careful drainage of cuts with drain tile will, to a great extent, avoid heaving of track in the winter time. Surface ditches should be kept clean, and all rubbish, grass, and shrubbery should be cut from the bottom of the ditches at least once a year. Good outlets should be provided for drains, so that the water can run away freely. The ditching on roads that have a great many cuts causes expensive maintenance, and great care should be taken to provide the proper slope for the banks in order to avoid sliding or washing. All slopes or cuts should be built the proper slope for the material, to keep it from sliding or washing down the track and ditches, and at times covering the track and mixing clay with the ballast, thereby doing a large amount of damage. The extra expense so caused would more than justify building the proper slope for the banks when the road is constructed.

All cuts should be provided with good surface ditches on top of banks. No water should be allowed to enter cuts. By good surface ditches on top of banks a large amount of sliding material can be avoided. In cuts drain tile ditches should be laid on each side of the track, about one foot from the end of the ties; on double track, drain tile should be laid between the two tracks, and cross drains provided about every 500 feet. Drain tile should be laid at least two feet below the top surface of the ballast, on the roadbed, and covered with porous cinders for about one foot. Borrow pits along the tracks should be connected with the nearest water course. Material should not be borowed to a greater depth than will permit proper drainage. Where water is standing near the track in borrow pits or other depressions, that cannot be drained, the pit should be filled in sufficient depth to prevent the standing of water near the track.

DEPTH AND KIND OF BALLAST.

On account of the increase in tonnage and speed in past years, this committee would recommend broken or crushed stone durable enough to resist the disintegrating influences of the weather and climate where it is used. It should be hard enough to prevent pulverizing under the treatment to which it is subjected, and stone should be selected that will break in angular pieces when crushed. The maximum size of ballast should not exceed that of pieces which will pass through screens having one and one-half to two inch holes. The minimum size should not pass through a screen having one-half inch holes. For new roadbed the depth of ballast should not be less than eighteen inches, but on old roadbed,

where gravel or cinder ballast has been used to a depth of ten or twelve inches, an additional six inches of stone ballast supplied under the ties will give good results. This class of ballast will be free from dust, which is a very essential point, as dust is very annoying to the traveling public during the summer season, when the weather is hot and the windows are left open. Gravel ballast, unless it is washed and the fine dust removed will be more or less dusty, and besides, a large amount of gravel is badly mixed with clay, and during wet weather gets soft and mushy, causing track to get loose and out of surface. Gravel ballast cannot be worked successfully while wet. Stone ballast can be worked during wet weather as well as in dry weather. While stone ballast is harder to work than gravel ballast it will maintain surface and line better than gravel and will make a more permanent roadbed.

SIZE, LENGTH AND SPACING OF TIES.

This committee would recommend seven inch by nine inch by nine foot ties as the proper size, to take care of and hold up the track under present traffic. We believe that by supplying more bearing surface outside of the rails better results will be obtained. While the present eight foot tie has been in universal use, it was of sufficient length until the heavy rolling stock was placed in use. The engines of today are much higher and wider than the engines of five or ten years ago, making the same top heavy, and the track department is expected to, and must, maintain the track with ties of the same lengh as were used with lighter equipment and rolling stock. We would recommend as the proper spacing of ties of eight inch face eighteen inches center to center; for nine inch face twenty inches center to center; shoulder ties at joints should be sixteen to eighteen inches center to center. This spacing would provide better bearing surface for the traffic of today. Ties should also be uniform in length, to supply an even bearing on both sides of the track.

WEIGHT, HEIGHT AND PATTERN OF RAIL.

This committee would recommend that for steam railroads on heavy traffic lines, rails weighing ninety to 100 lbs. per yard, and from thirty to thirty-three feet as the proper length. Rails weighing ninety to 100 lbs. per yard, at this length, will be heavy enough to handle and unload from cars and lay in track. This committee has observed that some of the failures of the present pattern of rail now used are caused by the head of the rail being too wide for the web. A stronger web is proportion to the head of the rail should be provided, to give sufficient support to the head of the rail, and avoid splitting or what is ordinarily called piping.

This committee would recommend that a rail five inches in height is high enough on account of the danger of spreading track. The higher the rail stands above its base or bearing the stronger is the leverage on the same. When we consider the speed of trains as high as seventy to seventy-five miles per hour, with a 200-ton engine, swinging back and forth on the rails and striking a blow which it is impossible to figure out, it stands to reason that the top of the rail should be kept within moderate height. The committee would recommend a rail with a six inch base and five inches in height, rolled in proportion, would be a safe and proper rail to be used with the present rolling stock. The wide base would materially lessen the tendency of the rail to cut into the ties. It will give a larger and a more solid bearing surface, and with this design of rail there should be less spreading of track.

RENEWING TIES IN DIFFERENT KINDS OF BALLAST.

Stone Ballast—If a general renewal can be made the best result will be obtained by lifting the track with jacks sufficiently high after the stone has been removed from beneath the ties that the old decayed ties can be removed without destroying the roadbed under the same, and then placing the new ties on the old fountain and resurfacing the track carefully and true. These ties should be carefully tamped with tamping picks. But when only two or three decayed ties are to be removed from under one rail and the track is in general good surface, it will not be justifiable to disturb the roadbed. In that case the cheapest and quickest way is to dig out for these ties so that they can be removed without disturbing the remainder of roadbed.

Gravel Balast—If a general renewal is to be made the best results can be obtained by lifting the track sufficiently high to remove the old ties without disturbing the roadbed, and permit the new ties to be carefully bedded. In this way the general surface of the track will not be disturbed. The new ties should be carefully tamped with shovels on the day they are placed in the track, and on the following day this track should be carefully resurfaced and all ties carefully tamped with tamping bars or picks. Where there are only from three to five ties to be removed in one rail length and the general surface is good it will not be proper to raise the track, but the decayed ties should be dug out and the new ties placed on the old foundation, as existing conditions will permit. On roads with very heavy and fast traffic all track should be resurfaced and carefully tamped with tamping bars or tamping picks on the same day the ties are put in, for the reason that if the roadbed is dug deeper in some places than in others the tendency will be to settle unevenly, and result in rough and unsafe track for fast trains. Track of this kind should be resurfaced and tamped the second time in the course of eight or ten days, and all new ties and low places should be carefully retamped.

PROPER METHOD OF SURFACING OR TAMPING TRACK.

To have true and even track it should be raised to perfect level. Great care should be taken by the foreman in charge to raise the track level. Sighting boards should be used and set at high points, in order that short sags can be taken out. All track should be carefully examined with a true level board before any raising is done in order to find out which side of the track is the higher. When this has been found out and the track is in general good surface, the low spots should be raised on the high side, and the other side should be raised by using a

true spirit level. It is of the greatest importance that both sides on tangents be on the same level. First it is necessary that the track be raised level. After the track is raised level it becomes necessary that the ties be tamped solid. In raising or surfacing up low places tamping bars or tamping picks should be used and all ties that have been raised should be tamped until they are solid. The hardest tamping should be done under the rail and on the outside and about fifteen inches on the inside of the rail. From there to the center of the tie tamping should be done only about half as hard to avoid the track getting center bound. In light raising in stone ballast tamping picks are the proper tool to tamp with, but in gravel ballast tamping bars are preferable. The joint ties should be tamped the hardest.

PROPER METHOD OF LINING AND FILLING IN TRACK.

In order to maintain good true line it is absolutely necessary to have true and exact gauge, and true and even surface. True line, true gauge, and true surface, are the three essentials of perfect track. The best results can be obtained by lining track after the raising and tamping has been done. The raising and tamping of the track should be so arranged that the track can be properly lined over the portion of the track raised during the day, and the track properly filled in and then completely finished up by the time to quit work, so the day's work will be entirely finished. The filling in of the track should be done in workmanlike manner. Ballast should be filled in solid between the ties and in the center of the track level with the top of the ties. From a point under the rail to the end of the ties the ballast should be sloped from about one-half inch below the base of the rail to two inches below the top of the ties at the end. This will give the water free outlet. The foregoing is intended to apply except where the conditions will allow the track to be dressed full.

Tangents should be adjusted by throwing the track between summets, between curves or by throwing the curves to meet the tangents; or by partly throwing the curves and partly throwing the tangents, as may better suit the conditions. Centers should be set with a transit to insure accurate line.

ADJUSTMENT OF CURVES WITH CONSIDERATION AS TO EASEMENTS.

Recommended: That Easement Curves should be as follows:

For speed not exceeding thirty miles per hour, on all curves exceeding two degrees.

For speed not exceeding sixty miles per hour, on all curves exceeding one degree.

When higher speed is attained, on all curves exceeding thirty minutes.

Easement Curves should be used between curves of different degrees in the same way that they are used between curves and tangents.

The length of the easement curve should be the same as the distance in which the curve elevation is run out; therefore, as the elevation of a curve depends not alone on the degree, but also on the speed of the trains, the length of the easement curve should vary in the same manner.

For ordinary practice, a chord length equivalent to 100 feet for each degree of variation in curvature is recommended.

Where the distance between curves will not allow this, or if for other reasons, a chord length of twenty-five to thirty feet may be used.

For very high speed roads, a chord length equivalent to 150 feet or more per degree of variation is recommended.

Any form of transition is satisfactory which gradually changes the degree of curvature, and in which the length of chord per degree of variation can readily be changed to suit each particular case, the essential point being that the length of the easement curve shall be the same as the distance in which the elevation of the outer rail is raised from zero to full elevation.

Any transition curve of the type of the Searles, Crandall, Holbrook, Talbot or the cubic parabola, which is susceptible of being run in by deflection or offset is good for this purpose.

Elevation of curves with special consideration as to the amount of the beginning and the end of the elevation as modified by the location of the curve and the condition of the traffic, will attain good results if the formulas which were expressed in our last proceedings are followed. Since the elevation required is a function of, and depends upon, the train speed, this speed is the first element to be determined in general as a matter of safety, the preference should be given to fast passenger traffic. The inner rail should be maintained at grade.

Committee: C. Buhrer, T. Hickey, M. Burke.

## *Passenger Station Facilities at Chicago*

THE statement of the proposed new Chicago Northwestern passenger depot of several months ago, and the actual need of that company for a station adequate for all purposes, has brought out considerable discussion. As nearly every one knows the peculiar situation of railways in Chicago and the dense traffic at some stations in rush hours makes the construction or location of a Union Station an almost impossible feat. This is realized at almost every station in the city where the traffic has outgrown the station. While it is true that no one could have correctly foretold this, nevertheless, an article from the Chicago Tribune of recent date seems to sum up the situation from the people's standpoint very concisely. This is given in full as follows:

"The passage of the ordinance permitting the Northwestern railroad company to build its new station and terminals should not be delayed by the council. It is an improvement which will require considerable time to complete. It is urgently needed and demanded by thousands of persons who use the suburban as well as the through trains. It is a public benefit of such importance that the council should give its consent to the improvement at the earliest possible day.

"The property condemned for the use of the road will be amply paid for, and the abutting property will share in

the benefit. If no other benefit to the city were secured but track elevation it should still call for prompt consent upon the part of the council, for the contemplated improvement practically means, so far as the Milwaukee division is concerned, track elevation from the station to the north line of Evanston. To learn what that means it is only necessary to look at Kinzie street, which is now rendered almost impassable by the great number of trains crossing it daily. The new station will be a benefit to the public, to the property owners, to the suburbs, and to the railroad, and it will be an injury to no one. There should be no delay, therefore, in granting the permission which the road asks.

"While the new station and terminals will be an enormous improvement, yet in less than twenty years the station will be found too small and the company will realize that it would have been better if it had bought two blocks instead of one, east and west, and had laid forty tracks instead of twenty. It is the history of great public improvements that they are outgrown almost before they are completed. This has been the case with the new postoffice building. The Lake Shore station, which was considered large enough at the time it was built, should have been twice as large. It is now just about the size to fit Cleveland, but is wholly unworthy of Chicago. The Illinois Central station, which was supposed to be large enough when it was built and a genuine improvement, is already out of date and a failure as a first class station. It never was good for much, and such facilities as it had were long ago outgrown. The worst failure of all is the Union station on the west side, which is a disgrace to the Pennsylvania road and to the city. It is unclean, insanitary, unsystematic, inconvenient, insufficient, and destitute of a suspicion of architectural beauty. It is warm in summer and cold in winter, dangerous, small, dirty, and abominable. The Polk and Harrison street stations are not much better.

"But the Union station, for which the Pennsylvania railroad is responsible, is such a violator of all the decencies and proprieties as to suggest that if there is a law regulating such offenses in this state it ought to be enforced, and if there is not such a law there ought to be one."

### *Track Prizes on the Missouri Pacific*

THE engineer of maintenance of way of the Missouri Pacific and Iron Mountain system has announced that prizes will be awarded track foremen and roadmasters for excellence in maintenance. The rules governing the award of these prizes have been issued in a circular letter, providing as follows:

A general inspection of the track of selected portions of the Missouri Pacific system will be held each fall for the purpose of studying the results obtained by the different division officers.

1. The selection of the route will be made shortly before the date of inspection.

2. The following premiums will be awarded as a result of the inspection:

(a) First premium, $200, to the roadmaster having the best average line and surface.

(b) Second premium, $100, to the roadmaster having the second best average line and surface.

(c) Third premium, $50, to the roadmaster having the third best average line and surface.

(d) Section foremen's first premium, $25, to the section foreman having the best average line and surface on each superintendent's division included in the inspection.

(e) Section foremen's second premium, ten days' leave of absence at full pay, with transportation for himself and immediate family to any point on the Missouri Pacific system, to be awarded the section foreman having the second best average line and surface on each superintendent's division covered by the inspection.

3. In addition to the system inspection, each division will make a track inspection in the fall, as a result of which the following premiums will be awarded:

(a) First premium, for section having the best average line and surface on each roadmaster's district. The section foreman will be given one week's leave of absence at full pay, with transportation to any point on the Missouri Pacific system, and a board marked "premium section" will be placed on his toolhouse, this board to be maintained until ensuing annual inspection.

(b) The foreman having the best section on the superintendent's division will receive a board marked "first premium section," and will be given ten days' leave of absence instead of one week.

In each case the leave of absence will be granted at such time prior to April 1, as may be arranged by the division engineer.

The Missouri Pacific & Iron Mountain System has established a comprehensive system for the inspection of bridges and buildings, as well as of roads and track. Inpections are now made daily, weekly, monthly, quarterly, half-yearly and yearly. The track foremen report daily to the supervisor of bridges and buildings the results of their observations. The bridge foremen make inspections and submit reports to the supervisor once a month. The supervisor of bridges and buildings makes a personal inspection trip every three months. The division engineer makes a personal inspection every six months and reports to the engineer of bridges and buildings. In the autumn a personal inspection is made by the engineer of bridges and buildings, who reports to the engineer of maintenance of way.

One of the many elements of cost in producing anthracite coal is brought out in figures compiled from reports of anthracite mine operators to the United States Geological Survey. These figures show that the total value of timber, sawed and round, used in the anthracite mines of Pennsylvania during the year 1905 was $5,310,000, or nearly eight and three-fourths cents per ton of coal produced. The total value of the sawed timber was $1,842,000, and of the round $3,469,000. Oak, hemlock and yellow pine were the principal woods used. These are but incidentals in the manufacture of anthracite coal.

## Tie Plates

*Report of committee presented before the annual convention of the Roadmasters' and Maintenance of Way Association.*

THE plates are now considered standard track material by the officers of our railroads, and their use is so generally known and appreciated that the committee feels a sense of unworthiness in attempting to add to the mass of literature written by far more able men than the undersigned. We shall, however, be satisfied should we succeed in giving you a better appreciation of the safety and economy resulting from a liberal use of this important track device.

The first form of tie plate manufactured and placed on the market was a small channel plate three-sixteenths inch thick, and three and three-fourths inches wide and any length required. This was about seventeen years ago. About two years afterwards, a three and four flange plate was offered, three-sixteenths inch thick, and was thought to be heavy enough at that time. It was a great improvement over the two-flange plate. This type gave an excellent service for a time, but the increase of traffic and the tremendous increase in the weight of engines and rolling stock, soon demonstrated that it was too light for the present condition; but it had fully proved its usefulness in saving the tie and preserving the gauge, and also in reducing the maintenance expense. It only remained for the officers of the railroads to increase the thickness of the plate to suit the present conditions, and keep up with the increase of rail and rolling stock .

A quarter-inch plate is the lightest used now and that for moderate traffic only; five-sixteenths inch plate for medium heavy traffic and three-eighth inch for heavy traffic. The latter is about the standard now for main line heavy traffic roads. Many of the small sized, lighter plates are still doing service, and can be found on nearly all soft tie roads, with a record of twelve to fourteen years, but they are being replaced very fast where increase of rail section and renewals, change of line and grade, etc., are made.

The three-eighth inch tie plate (flange plate), is standard on the following roads: C. & N. W., Mich. Central, Ill. Central, N. Y. C. & H. R., L. S. & Mich. Sou., Southern Railway System, Norfolk & Western, Northern Pacific, Great Northern, N. Y. Central, and St. Louis, and others.

That the tie plate is a necessity has been conceded. It is indispensable. The only question now is, how heavy must the tie plate be to meet the heavy traffic of today and give first-class service under all conditions. It is a matter of selecting best material only.

There are now many plates on the market of different designs varying in detail only. Most of the plates are rolled in deep, thin flanges on underside, running in the direction of the plate, and when embedded in the tie, unite so firmly that it becomes a part of the tie and this prevents the abrasion already explained. All movements now take place between the rail and the plate, metal against metal, instead of metal against wood fibre.

One of the plates designed and successfully used in the Cross Grain Claw Plate. It has a shoulder on the upper surface to abut against the outer base of rail and has four one inch claws on under side. These claws enter the tie with a clean cut across the grain and gives not only great adhesion to the tie, but also offers enormous resistance to rail spreading.

The safety of traffic from the use of tie plates is fully understood and appreciated. No modern track material has gone so far to lighten our burdens as the tie plate. Track equipped with the proper plates and carefully applied is always safe. Spread track is now a thing of the past.

It is hard to estimate in figures the saving in use of ties, but it is well known it is very great. By their use the life of ties is extended several years. Ties are no longer spike killed; adzing ties to roll the rail back into normal condition is no longer necessary. Chasing section men from one curve to another, spiking places that seem to be more inclined to spread than to remain in place, take the time of the track-man.

The derailments caused by the spreading of the track have greatly diminished since the use of tie plates of all kinds. The creeping of rails has been retarded by the use of tie plates, from the fact that every spike is flush against the rail, as well as the friction of thirty-six steel pieces under a thirty foot rail.

Plates without flanges or flat bottom plates do not hold track to guage and do not have equal buckling strength for a given size flange plate. They do buckle, creep off the tie pulling the spike with them; they damage the fibers; in time destroy them and if they are always loose, how can they hold track to gauge?

With regard to a model tie plate our conclusions are drawn as follows:

1st—Should be so constructed as to make itself a part and parcel of the tie; in other words, fasten itself to the tie with the least amount of detriment to he fibre of the wood.

2nd—Should be so constructed as to prevent the spreading of the track, assist the spike and other work.

3rd—Should be so constructed as to give the greatest amount of buckling strength.

4th—Should have flanges of sufficient length to give frictional resistance and sufficient body to prevent buckling.

The standards of our tracks have been wonderfully increased since the advent of the tie plate and we strongly recommend a more generous use of them, being fully convinced that it means better, safer and more economical maintence and operation.

Committee: J. A. Kerwin, Chairman, St. L. I. M. & S., B. A. West, A. T. & S. F., C. M. Cornell, C. I. & L.

### *The Reliability of Reinforced Concrete.*

The power of a few men, or of even one man, to wreck, by ignorance or carelessness, a well and carefully devised scheme of construction is a matter that must always be borne in mind by engineers, particularly in relation to structures in which the work, once done, cannot be inspected, nor any certain assurance be obtained that it is sound and reliable. It may, of course, be said that there is no certainty that any material is absolutely reliable, for in every member of, for instance, a steel lattic girder bridge the closest inspection may fail to tell us if the internal structure of the various parts is what we have specified or what we expect it to be. This is perfectly true, and yet with careful tests made on samples of the materials which enter into the structure of the bridge, it is possible to minimise the chance of any serious mishap taking place, as also, in a case of this kind, it is very unlikely, even if there be some flaw in a certain part, that it would cause disaster to the structure as a whole.

There are, however, kinds of work in which, when once the material is in place, the power to tell whether everything is right is practically removed, and, unless such work has during construction been under the eye of someone thoroughly alive to the possibilities of neglect, and who, moreover, is above suspicion, so far as the conscientious carrying out of the work is concerned, there will remain an uncomfortable feeling that there is no certain assurance that the work is reliable. In this category may be mentioned those works which depend for their strength both on the quality of the materials used and on the manner in which they are combined.

In a marked degree reinforced concrete illustrates our point: excellent when properly designed, and when constructed under trained and conscientious supervision; uncertain and dangerous when executed without due regard to these vital conditions. We have had occasion before to call attention to the danger there is that the reputation of this excellent material may suffer greatly from ignorant and careless use, but we make no excuse for alluding to it again, for it seems to us that it is almost the only weak point the material has—it is too much at the mercy of the careless unwatched workman. But it is surely a weakness that can and ought to be guarded against. Careless workmanship at any rate should be made practically impossible by unceasing supervision. A failure quite recently happened in America which, however, may be taken as typical of the result following the laxity which is so particularly to be guarded against. Though, fortunately, unattended with loss of life, the destruction of property was very considerable, and might very easily in addition have been accompanied by a long list of fatalities. The failure to which we refer was that of a reinforced concrete chimney, 223 ft. high from the bottom of the foundations, which had just been completed.

The chimney was 11 ft. in diameter inside, the lower portion, up to a height of 92 ft. above the bottom of the foundation, having an inner shell as a heat-resisting lining. In this part the chimney was 8 in. thick in the outer shell, and 4 in. thick in the inner shell, though the two shells were quite distinct, with a 4-in. air-space between them. From a point level with the top of the inner shell the upper part of the stack was carried up to the top as a single shell, having a thickness of 6 in.; its inner diameter being the same as that of the heat-resisting lining below—namely, 11 ft. The outer diameter of the upper part of the chimney was therefore 10 in. less than that of the lower part, and the chimney at the junction of the upper and lower part was thickened out, the concrete being splayed out from the 6-in. thick part, in a length of 3 ft.

It was in this portion of the stack that failure occurred; the concrete, without any warning, suddenly gave way after being completed for three weeks, and the whole of the upper part of the stack fell into a power-house below, and caused damage to the amount of about $8,000. Although about twenty men were in the power-house at the time, none of them was injured.

Tests of the cement used showed that neat briquettes had a tensile strength of about 700 lb. per square inch at the end of seven days, and 900 lb. at the end of twenty-eight days, and briquettes composed of one part of cement and three parts crushed quartz had a strength of about 120 lb. at the end of seven days, and 190 lb. at the end of twenty-eight days.—*Engineering.*

### *The Track Foreman*

THE recent meeting of the Roadmasters' association in Chicago calls attention to the kind of work and the character of the men with which they are principally concerned.

A roadmaster, as a rule, has charge of several hundred men who are divided into gangs of five, ten or fifteen men, and each of these gangs is in charge of a track foreman, who is really the first element in a railroad organization and the foundation upon which the elaborate structure is built. The labor connected with the maintenance of railroad track is generally regarded as of the most ordinary kind, and while most of the work performed is such, yet the skill and knowledge necessary to properly supervise this work should make that supervision rank as a trade. The track foreman is not, as a rule, one whose education is obtained in the schools, but his training comes through long and patient experience with the most laborious of work, and with the most ignorant of men. His nationality in the past has generally been Irish, but the Irishman of late is "going up" seeking better employment, and track work is now being supervised more by Italians and Scandinavians.

For the maintenance of the roadway the railroads in the United States employ on an average only one trackman per mile of track, and it seems remarkable that so much can be accomplished with so small an amount of labor. The work includes the replacement of ties, rails, fastenings, frogs, switches and ballast. The grass and weeds on banks must be cut, new and old material handled, the ditches kept open, fastenings adjusted, gauge and mine maintained by re-spiking, adzing, raising joints and putting in ballast; there are besides all this the re-

moval of snow and ice, and the repair of the damage constantly being done by water and weather.

The number of men under the direction of a track foreman varies from five to fifteen, and it is estimated that the number of such foremen employed in the United States is nearly 40,000. The duties, responsibilities and remuneration of this humble railway official are not frequently discussed and they seldom form the subject of a club paper or an association report. In the Proceedings of the Engineers Club of Philadelphia (October, 1906), is a paper on railroad foremen, by Mr. S. W. Kapp, in which the subject is given a systematic and thoughtful treatment. Here is an attempt to classify the knowledge which the track foreman should possess: He should be well informed as to the effect of temperature on the expansion and contradiction of rails; of frost in heaving the track; of ice in obstructing drainage and of cold on exposed masonry; of ice or frost forming under the rails in decreasing the frictional resistance to spreading and throwing more pressure against the spike; of the creeping and pulling of rails under change of temperature; of the action of wind on snow and sand, on trees along the track and on fire near the right of way; of moisture producing high water, cutting embankments, undermining masonry and softening the roadbed; of friction in causing the wear of rails and frogs; of the deterioration of metal structures from salt air or salt water, and locomotive gases; and in general the effect of age on ties and ballast and other track materials.

In addition to the physical problems which are here but briefly scheduled, the track foreman must be well posted on the operating rules, the practices affecting the running of trains and the shipment and inspection of materials. He must exercise good judgment in track repairs and renewals so as not to interfere with the movement of trains; he should maintain amicable relations with his associates and the railroad's neighbors, and above all he must understand human nature and have some skill in the management of men.

The track foreman is something of an engineer; he starts with material and labor and by proper combination produces the finished work. The foreman should by nature be leaders of men, and the largest success attends those who can organize and lead men. Mr. Kapp says: "Track foremen as a body know more about the proper elevation of the outer rail than do engineers. Engineers have developed the theory of the outer rail on the basis of centrifugal force. The foreman developed their theory of elevation from watching the trains go around curves. The actual elevation is always a compromise. The theoretical elevation is usually wrong and the foreman can make a better adjustment than can the engineer. As to line, many foremen can put up better track and line than engineers, and sharp curves traversed by high-speed trains are maintained by foremen without the assistance of engineers."

The responsibility of the track foreman never ceases, day and night, summer and winter, and his burden is often great. In times of flood and high water, in extremes of temperature, in blizzards felt more keenly when others seek shelter from the elements, he is found at his post of duty. Such is the character and these are some of the duties and responsibilities of the track foreman, and it would naturally be expected that the training and selection of men for the position would be regarded as of first importance, and the remuneration would be somewhat commensurate with the ability of the men and their responsibilities.

In this regard we are informed that the wage of track foremen is much less than those in the mechanical trades, averaging only $55 to $60 per month, and that this low compensation is driving the younger men into other occupations. The effect of this is being seen and felt among the men now in service. They are growing old and good material is not forthcoming to fill the places which will become vacant with increasing frequency in the future. It is already a serious problem to find men who are willing and competent to continue the work of the maintenance of our vast systems of railroad tracks. Modern equipment will cause it to depreciate more rapidly, and unless wages are made sufficient to induce men of proper character to remain in the service, the maintenance of track will be an a gradually descending scale of efficiency and not anly will equipment be worn out more rapidly, but accidents due to derailments caused by defects in the track will be on the increase. The faithful old-time track foreman will soon be on the penson roll. Are conditions being made favorable for an equally efficient man to take his place?—The Railway Age.

## Personals

Mr. E. W. Wiggin has been appointed engineer of bridges and buildings of the Missouri Pacific, with office at St. Louis, Mo.

Mr. D. E. Marts has been appointed roadmaster of the Trinity & Brazos Valley at Teague, Tex.

Mr. A. C. Eddy has been appointed resident engineer of the Great Northern at Seattle, Wash., in place of Mr. C. H. Swigart, resigned.

Mr. A. E. Bachert has been appointed chief engineer of the East Broad Top, with office at Robertsdale, Pa.; effective on October 22.

Mr. J. W. Williams has been appointed acting chief engineer of the San Francisco & Northwestern, with office at San Francisco, Cal., to succeed Mr. H. C. Phillips, promoted.

Mr. E. E. Turner has been appointed roadmaster of the Missouri Kansas & Texas at North McAlester, I. T., in place of Mr. A. P. Black.

Mr. Edwin B. Katte's appointment as chief engineer of electric traction of the New York Central & Hudson River Railroad became effective on November 1.

Mr. Claude Betson has been appointed engineer of the Rio Grande division of the Atchison Topeka & Santa Fe at San Marcial, N. M., in place of Mr. F. T. Beckett.

Mr. R. T. Horton, resident engineer of the New York Central & Hudson River, at Buffalo, N. Y., has been transferred to the Mohawk division, at Albany, N. Y.

Mr. T. K. Minsker has been appointed assistant supervisor of division No. 34 of the Pennsylvania & Northwestern division of the Pennsylvania, vice Mr. J. H. Redding, transferred.

Mr. William H. Bush, chief engineer of the Central of Louisiana, with headquarters of New Iberia, La., has been appointed locating engineer on the Kansas City Southern at Kansas City, Mo.

Mr. Clement E. Crowley has been appointed assistant engineer of the Northern Railway, with headquarters at San Jose, Costa Rica, vice Mr. H. M. Field, resigned.

Mr. C. L. Spaulding, division engineer of the New York Central & Hudson River at Schenectady, N. Y., has been transferred to Yonkers, N. Y., in charge of grade crossing work in the electric zone.

Mr. H. W. Lewis, heretofore supervisor of signals of the Lehigh Valley at Easton, Pa., has been appointed signal engineer, with headquarters at South Bethlehem, Pa., to succeed Mr. C. C. Rosenberg, resigned.

Mr. E. C. Bagwell has been apopinted engineer of the Seaboard Air Line at Savannah, Ga., succeeding Mr. W. D. Faucett, who has been appointed assistant to the chief engineer at Portsmouth, Va.

Mr. C. F. Blue, superintendent of way and structures of the Mobile & Ohio, with headquarters at St. Louis, has had his jurisdiction extended over the Southern Railway Company in Mississippi.

Mr. T. S. Leake has been appointed superintendent of buildings of the Missouri Pacific system, with headquarters at St. Louis, Mo. Mr. F. B. Scheetz, heretofore engineer of bridges and buildings, has been appointed superintendent of bridges, with office at St. Louis.

Mr. George A. Berry, who recently resigned as engineer of company forces in the electric zone of the New York Central & Hudson River, has been elected vice-president and general manager of the Hicks Locomotive & Car Works, with headquarters at Chicago.

Mr. C. B. Yancey, supervisor of the Central of Georgia, at Carrollton, Ga., has been transferred to Griffin, Ga., in a similar capacity, succeeding Mr. J. B. Glover, who has been appointed coal inspector of the company's mines near Birmingham, Ala.

The following announcement has been issued by Superintendent Man of the Missouri & North Arkansas under date of October 15: Effective this date, Mr. J. B. Skelton is relieved of all duties pertaining strictly to track maintenance, retaining direct supervision of bridge and building construction and repairs, with the title of master carpenter, with office at Eureka Springs, Ark. Mr. Edward Eagan is appointed roadmaster in direct charge of track work proper, with office at Harrison, Ark.

Mr. A. G. McComb, who resigned as chief engineer of the Pittsburg Shawmut & Northern on October 15, will engage in the contracting business, with office at Olean, N. Y. The office of chief engineer has been abolished and Mr. Herbert S. Wilgus has been appointed engineer of maintenance of way instead of chief engineer, as previously stated. The latter is a brother of Vice-President Wilgus of the New York Central Lines and was formerly connected with the Cleveland, Cincinnati, Chicago & St. Louis and the Pennsylvania Lines West.

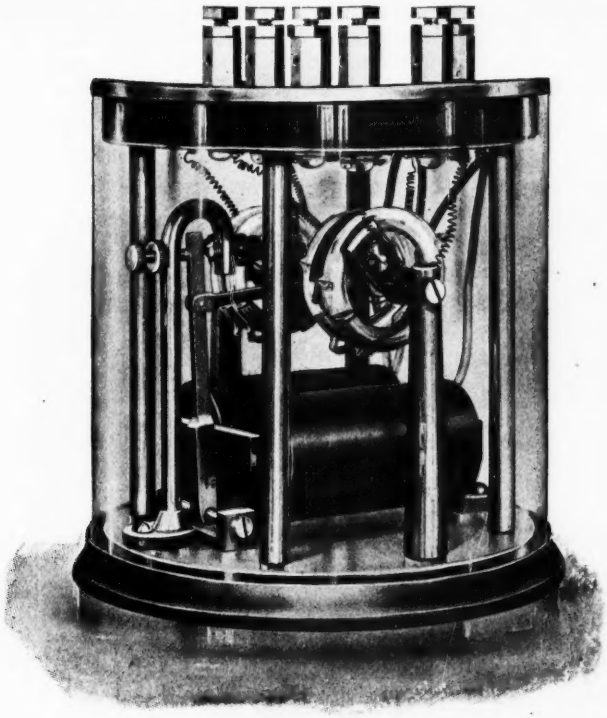
Mr. Edwin B. Katte has been appointed chief engineer of electric traction, and Mr. George A. Harwood chief engineer of electric zone improvements, exclusive of electric traction and signals, of the New York Central & Hudson River R. R., with headquarters at New York.

The New York Central & Hudson River Railroad Company announces the appointment of Mr. John D. Keiley as electrical engineer, and Mr. Carl Schwartz as engineer of power stations, with headquarters at New York.

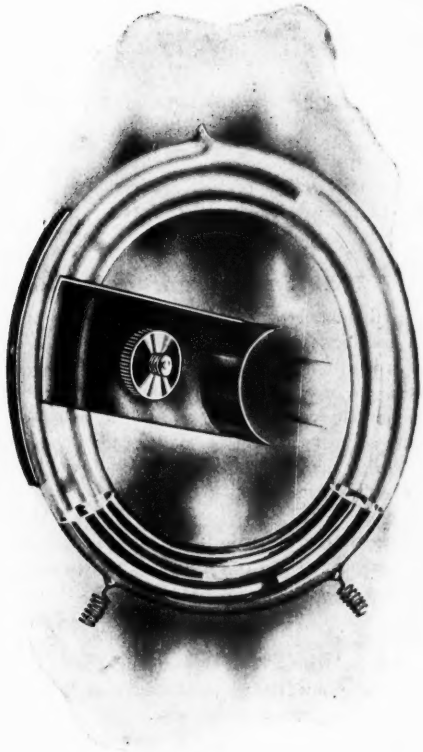
Mr. C. F. Graff, Spokane, Wash., has resigned as locating engineer of the Chicago, Milwaukee & St. Paul, and will devote himself to general building and structural work, specializing in reinforced concrete work.

Mr. L. C. Fritch has been appointed Assistant to the President of the Illinois Central Railroad, with office at Chicago, Ill. Mr. Fritch entered railroad service with the Ohio & Mississippi Railroad in 1884, in the Engneering Department; was promoted to assistant engineer, and in October, 1892, was appointed engineer maintenance of way of the same company, and chief engineer of the Cincinnati & Bedford Railroad. In November, 1892, he was appointed division engineer of the Baltimore & Ohio Railroad, which company absorbed the Ohio & Mississippi Railroad; September, 1899, was appointed superintendent of the Mississippi division of the Baltimore & Ohio Southwestern Railroad. In February, 1904, he entered the service of the Illinois Central Railroad, being engaged in special work for the assistant general manager. In 1905 he was appointed assistant to the general manager. Mr. Fritch was for several years secretary of the American Railway Engineering and Maintenance of Way Association; he is also a member of the American Society of Civil Engineers.

The New York Central & Hudson River R. R. Co., in connection with its electric zone improvements, announces the following appointments: Mr. W. H. Knowlton, principal assistant engineer, who will have direct charge of all contract construction work and right-of-way matters from the south bank of the Harlem River to Peekskill and North White Plains; Mr. J. L. Holst, appointed engineer of structures, in charge of the design and erection of all steel in the electric zone, excepting erection in the Grand Central Terminal; the design of all buildings not in charge of the Associated Architects, and the design of all masonry and miscellaneous structures north of the south bank of the Harlem River; Mr. W. F. Jordan, appointed terminal engineer, in charge of the design and construction of the Grand Central Terminal and other work in connection with the electric zone improvements south of the south bank of the Harlem River, except the structural steel design and the Grand Central Station and other work in charge of the Associated Architects; Mr. L. H. Byam is appointed engineer of company forces. He will execute work with his own forces in accordance with authorities signed by the principal assistant engineer or terminal engineer accepted by himself and approved by the chief engineer.



THE M'CLINTOCK SIGNAL RELAY

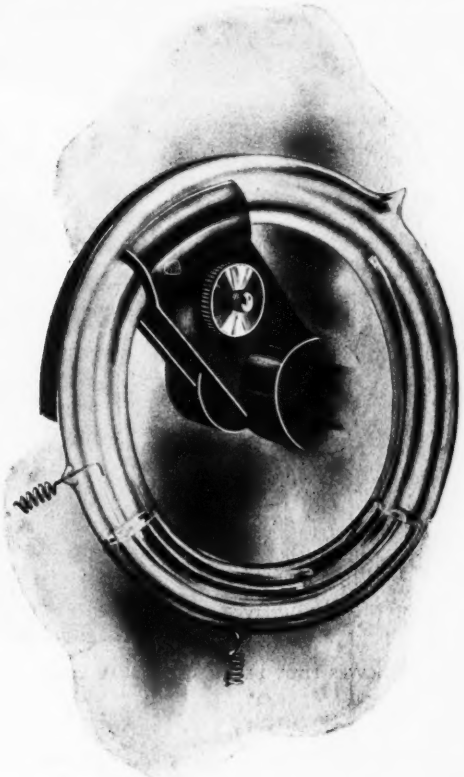


CONTACT RING SHOWING POSITION OF MERCURY AND CONTACTS ON CLOSED CIRCUIT—M'CLINTOCK SIGNAL RELAY

## *The McClintock Signal Relay*

Railroads are coming more and more to realize the need of efficient signaling service. The prompt and efficient working of signals is a matter involving not only the safety of passengers and property, but the subsequent loss or gain of valuable time in handling trains. This latter point is one of vast importance to a matters of efficiency and simplicity the McClintock Mfg. Co., of road handling traffic to any considerable degree of density. In St. Paul, Minn., is putting out some electric signals that rank among the higher class productions.

The McClintock Signal Relay, an illustration of which is given here, is a relay of rare merit. Its contacts are positive and



MERCURY CONTACT RING SHOWING POSITION OF MERCURY AND CONTACTS ON OPEN CIRCUIT—M'CLINTOCK SIGNAL RELAY

reliable and devoid of any sliding friction. It is well protected from dust, moisture, oxidation or corrosion and does not permit of the freezing of its contacts. The relay consists of the coils mounted in a horizontal position on a handsome metal base. The armature is fastened to a vertical lever which is pivoted between cylindrical bearings.

Time, effort and expense have not been spared in making these relays and they are as near perfection as human skill can make them. Illustrated pamphlet containing detailed information can be had on application to the McClintock Mfg. Co., St. Paul, Minn.

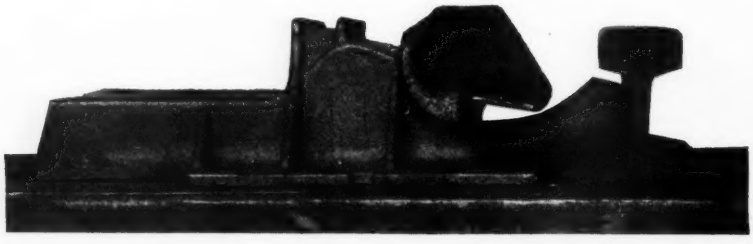
## *The Hayes Derailing Device*

The requirements for a good derailing device may be summed up in these two points, efficiency and simplicity. There are many derailers on the market today but for practical and hard usage they have fallen into some disrepute owing to their complicated parts.

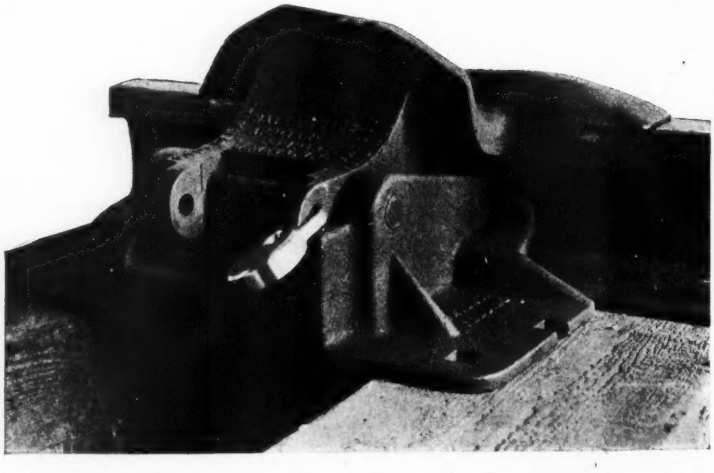
The Hayes Track Appliance Company, of Geneva, New York, are putting two styles of derailers on the market that for the above mentioned requisites, cannot be excelled.

Their "Lifting Derail" consists of two substantial malleable castings without any cranks, hinges or gears. It is easily placed

in position. Six spikes or lag screws secure it to the ties without any disturbance or injury to the rails. With this type the main rail is unbroken. Even if the derail is halfway open a wheel will not be derailed, but the derail block will be shoved away from the rail by a passing wheel. Its make-up also permits like the "Lifting Derail" requires no cutting of the rail. The "Pivot Derail" is intended of course more for local spurs and tracks that are not used frequently. One important advantage of these derailers is the increase of track room as compared with the ordinary split rail type. A sixteen page illustrated circular



HAYES LIFTING DERAIL CLOSED; WITH 80-LB. A. S. C. E. RAIL. ALL PARTS LOW WITH RESPECT TO RAIL. AMPLE FLANGEWAY

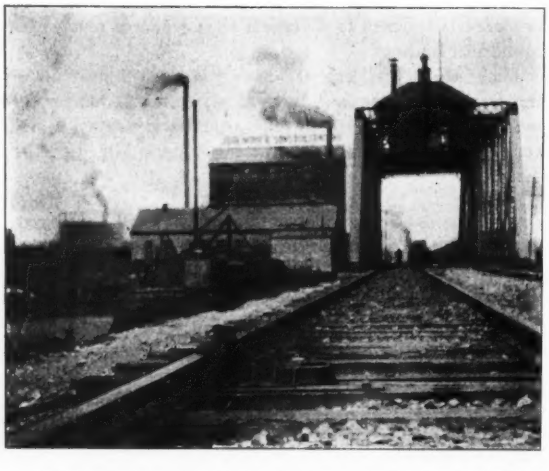


HAYES PIVOT DERAIL OPEN; REAR VIEW ON POINT SIDE SHOWING POSITION OF LOCK; THE HOLE IN THE LEFT LUG IS FOR THE CONNECTING ROD OF TARGET

of a connection by pipe line or otherwise to the main line switch-stand.

As to the "Pivot Derail" which this company is also making, it is designed for hand operation only and is not intended for man line connection.

This derail requires but four spikes to hold its position and



HAYES DERAIL OPEN—ON TRACK APPROACH TO DRAWBRIDGE

giving full details will be sent on application to the Hayes Track Appliance Company, Geneva, New York.

## *The Smith Improved Nut*

Among the numerous devices for holding nuts fast to the bolt and keeping all parts bolted together tight, shown at the recent Roadmasters' Convention, there was one device which combined both of these features in one piece. This is known as the Smith improved nut. It is a spring nut designed to follow up by the powerful spring at the end, any tendency of the parts to work together and thereby slack off the bolt.

It is a well known fact that the ordinary nut secured in place by a cotter pin or other positive device does not keep parts tight, for while the nut may remain in its original position on the bolt, the wear between the parts causes a tendency to settle together thereby leaving the bolt loose. This serious defect must be overcome by taking up the slack, either by constant use of a wrench or by allowing the matter to be handled by a powerful spring which needs tightening only occasionally. It is claimed for the Smith improved nut after a long series of heavy service tests that it has made good in every way.

In addition to its ability to stay tight it will be of interest to know that where it is necessary to remove the nut the Smith nut is essentially not a murderer of the threads as are so many locking devices based on a distorted thread or a distorted bore in the nut. The nuts are used for frog and crossing work exten-

sively, as well as for straight track work. For the latter they are furnished ready for service on the usual track bolt manufactured at the plant of the nut manufacturer.

The sale of this nut is controlled by the Railway Specialty and Supply Company, Great Northern Building, Chicago, who handle many other railroad supplies, among others the Casey conductor's lanterns, waste, springs, railroad tinware, Buckeye lights, special track work, frog and switch material, they being direct representatives of the above accounts, as well as handling a general line of railroad supplies.

SMITH IMPROVED LOCK NUT.—NO THREAD IN EXPANDED END

SMITH IMPROVED LOCK NUT APPLIED TO FROG

## *Buda Lining-Up Jack*

A new jack for lining-up purposes has been recently developed and perfected, which combines lifting and traversing features, both operated by one interchangeable lever. The economy of its use is evident to anyone familiar with track maintenance, who will compare the work done by this jack and two men, with work which would otherwise require the services of eight men provided with lining bars.

This jack is shown by the accompanying illustrations, one of which shows it with the lever in position for lifting rails and ties, and the other represents the jack with the lever reversed for throwing track into line.

Two jacks are used in pairs for track lining purposes. A load is raised half a notch by down and upward strokes of the lever, and the lifting bar is held in an elevated position by a special dog, while the lever is reversed and placed in the lower sockets to force the track in desirable line.

The entire device is composed of a traversing base and jack proper. The base is provided with a handle at one end and may be carried separately. A convenient handle in the form of a spur, near the top, permits the jack to be easily carried and placed in position. The parts of this jack are made up of the best materials. The frame and base are of refined malleable iron; the racks of forged steel, with machine cut teeth; the pawls are of drop forged, open hearth, high carbon steel; the fulcrum pin is machined and is made of high carbon rolled steel, and the bearings are of hardened steel.

In lining up work sufficient earth is removed between the ties to allow the base of the jack to slide beneath the rail and form a firm level foundation. The jack, being slid into the grooves of the base, is brought up so that the foot rests under base of rail. The rail is then lifted by using the lever with fulcrum resting in upper sockets, and the lifting process should continue only until the ties are loosened from the earth and not to an extent that would allow cinders and gravel to fall in and under the ties. When the proper height has been attained the lifting bar, or rack, is held in this position by a dog operated from the outside, by a lever which will be found at the top of frame on the right-hand side. When this is a set, the lever is taken out and reversed and fitted into the lower sockets, allowing the pawls to fall into the rack that extends along the center of the base. The track is then powerfully forced into proper line. By slightly loosening the ballast at the end of the ties this may be somewhat facilitated, though the capacity of the jack and powerful leverage obtained does not make this absolutely necessary. When the required alignment is obtained the lever is placed in the first position and after raising half a notch the load is tripped by the same arrangement used on the No. 1 ratchet jack, made by the manufacturers of the Buda lining-up jack.

BUDA LINING-UP JACK WITH LEVER IN UPPER SOCKET FOR RAISING TRACK

While originally designed for lining-up purposes, it will be seen that this style of jack may be effectually used for replacing cars and for general wrecking purposes. The combined capacities with the mechanical advantages of the traversing feature, make a pair of these jacks valuable and handy accessories, and a road with sections thus equipped may speedily secure at all points acceptable and desirable assistance with a great saving of delay and expense.

These jacks will be found particulary useful during the

months when it is the usual custom of railroads to considerably reduce the section force. As it requires six to eight men, equipped with lining bars, to line up track, it is evident that during those seasons of the year when the section force is very small, work of this nature is necessarily neglected, and when the track requires alignment to an extent that makes further delay impossible, it becomes necessary to call men together from sections often extending some thirty miles or more.

The value of these jacks for use on branch lines will also


BUDA LINING-UP JACK WITH LEVER IN LOWER SOCKET FOR FORCING TRACK INTO LINE

be seen. On account of their smaller earning capacity, branch lines are seldom, if ever, supplied with a force adequate to do the work of lining up. The result is that the track is in bad shape in this respect and gets attention only at rare intervals, when a special gang may be detailed on the work. As a dirt bed is generally encountered on these short lines the work can be done even more rapidly than on the main line where heavier ballast is in use.

It should be observed that a jack of this type can be used without the base for the same purpose as the Buda Standard No. 1 Trip Ratchet Jack.

The Buda Lining-Up Jack has been placed on the market only after being perfected and submitted to practical working test in actual railroad service. It is manufactured and marketed by the Buda Foundry & Mfg. Company, Chicago, Ill.

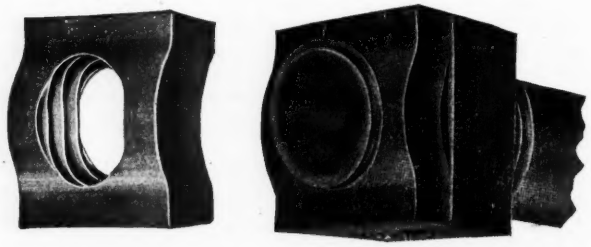
## *The Grip Nut*

While there have been many devices intended to secure nuts on bolts that are under severe jar and vibration strains, most of them consist of several pieces and are more expensive than the ordinary nut without the strength and wearing quality. The Grip nut on the contrary is a very simple device, a "one piece" steel nut made with an arched section at the thread portion, bars of steel of this section are rolled in suitable lengths and the grip nuts are sheared and punched at one operation by automatic machinery. The nut is tapped—threaded—the same as a standard nut but after it is threaded it is run through a deflecting press which deflects the threads slightly at the crown of the arch. This changes the pitch of the threads of that portion so that they have a slight downward curve, causing them to grip upon the bolt and the nut locks itself on the bolt regardless of its contact with the main nut. These nuts are no experiment, they have been tested on crossing, frog and track joint bolts for three years and in this severe service are said to have demonstrated their effectiveness in every case. They have been tested for strength and efficiency by Robert W. Hunt & Company, who invstigated the strength and frictional resistance of different sizes of grip nuts from ⅜ inch up to one inch. It was found that the smaller grip nuts had a strength equal to that of the bolt, while the one inch nuts had a strength equal to 65 per cent of that of the bolt, the tensile strength of the bolt material being taken at 65,000 pounds per square inch. In the test of the frictional resistance on a one-inch track bolt when screwed on until the bearing face of the nut was 1¼ inches from the end of the bolt, the pull necessary to unscrew the nut with a wrench having a radius of 18 inches was 34 pounds and the turning moment 612 inch pounds. The pull necessary to unscrew the nut when force was applied at its corner was 583 pounds and that necessary at the thread 1,224 pounds.

The grip nut does not have to be jambed upon the first nut as it does not depend upon the friction of contact with the first nut for its grip, but locks itself upon the threads of the bolt on account of its eccentric threads. It is thus not a jam nut, a spring or a spilt nut and it does away with spring lock washers, cotter pins, keys and other similar devices which have been used to secure nuts in place where it is important that they remain fixed in their normal position.

The Grip Nut Company with offices at 152 Lake St., Chicago, and 500 Fifth Ave., New York, have a new mill which is busily employed and turns out nearly 200,000 nuts per day.

Grip nuts are used extensively on electric railway tracks and equipment. They are usually applied first on crossings, then



THE GRIP NUT

their use extends to track joints and then to the mechanical and repair department. It is particularly useful in securing the nuts on the column bolts of diamond freight trucks and on the heavy service track crossings.

A very neat blotter in two colors has just come in from the makers of Paroid Roofing, F. W. Bird & Son, East Walpole, Mass. The subject is "First Expedition to Cuba" and refers to a large order for Paroid just received to cover buildings at Newport News, Va., where the first expedition to Cuba recently started. This firm is continually getting out neat advertising matter, especially about their Paroid Roofing. Your name will be placed on their regular mailing list if you will write them.

The C. W. Hunt Company, New York, is putting out some attractive literature calling attention to their industrial railways, electric storage battery locomotives, coal handling machinery, conveyors ad steam hoisting engines. Special exploitation is made of the refinements introduced in their electric-driven hoists with open and enclosed gears. In the latter design, the gears are enclosed in an oil-tight cast iron case, making an admirable arrangement for coal dealers, gas plants and contractors, since it is especially adapted to places where there is dust, or where the care of machinery is in unskilled hands.

# RAILWAY ENGINEERING

## AND MAINTENANCE OF WAY

VOL. II. CHICAGO DECEMBER 1906. NEW YORK NO. 12.

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Buda Foundry & Mfg. Co., Chicago.
Baldwin Steel Co., New York.
Millers-Falls Co., New York.
**Track Guages and Level.**
Buda Foundry & Mfg. Co., Chicago.
Railway Supply Co., St. Louis.
**Track Jacks (See Jacks.)**
**Track Signs.**
Adreon & Co., St. Louis.
Buda Foundry & Mfg. Co., Chicago.
**Track Tools.**
Adreon & Co., St. Louis.
Buda Foundry & Mfg. Co., Chicago.
Detroit Tool Co., Detroit, Mich.
Millers-Falls Co., New York.
Railway Supply Co., St. Louis.
Walters & Okell, Ft. Madison, Ia.
**Transfer Tables.**
Nichols, Geo. P., & Bro., Chicago, Ill.
**Trench Braces.**
Potter Mfg. Co., Indianapolis, Ind.
**Trench Machinery.**
Potter Mfg. Co., Indianapolis, Ind.
**Turnbuckles.**
Cleveland City Forge & Iron Co., Cleveland, O.
**Turntables.**
Nichols, Geo. P., & Bro., Chicago.
**Valves.**
American Valve & Meter Co., Cincinnati, O.
**Varnishes.**
Devoe, F. W., & Co., New York.
**Velocipedes, Railway.**
Buda Foundry & Mfg. Co., Chicago.
Railway Supply Co., St. Louis.
**Ventilators.**
**Ventilators, Cast Iron.**
**Vises.**
Detroit Tool Co., Detroit, Mich.
Adreon & Co., St. Louis, Mo.
Dickinson, Paul, Chicago.
**Vise, Combination Tool.**
Detroit Tool Co., Detroit, Mich.
**Vises, Pipe.**
Henderers, A. L. Sons, Wilmington, Del.
**Water Columns.**
American Valve & Meter Co., Cincinnati, O.
**Water Meters.**
American Valve & Meter Co., Cincinnati, O.
**Water Purifiers.**
American Water Softener Co., Philadelphia, Pa.
Kennicott Water Softener Co., Chicago.
**Water Softening Apparatus.**
American Water Softener Co., Philadelphia, Pa.
Kennicott Water Softener Co., Chicago.
**Water Tanks.**
Adreon & Co., St. Louis.
Railway Supply Co., St. Louis.
**Well Drilling Machinery.**
Keystone Driller Co., Beaver Falls, Pa.
**Wire Rope.**
Railway Supply Co., St. Louis.
**Wrecking Cars.**
Buda Foundry & Mfg. Co., Chicago.
**Wrecking Frogs.**
Railway Supply Co., St. Louis.
**Wrenches.**
Williams, J. H., & Co., Brooklyn, N. Y.

# The Railway Engineering Index

Railway Engineering Assn. 1 table. 800 words. Engineering World, Nov. 2, 1906.

**MISCELLANEOUS.**

**Proposed Tunnel Under the English Channel.** By H. Prime Kieffer. European and American Views of First Construction. 3 illustrations. 3,000 words. The Contractor, Nov. 15, 1906.

**The South & Western Railway.** A general description of improvements being made on this road. 8 illustrations. 2,100 words. Railway Age, Oct. 26, 1906.

**Tracing, Lettering and Mounting.** By I. G. Bailey. 2 illustrations. 1,200 words. Railway Machinery, Nov., 1906.

**The Ventilation of the Boston Subway.** By H. A. Carson. 1,100 words. Proceedings of the American Society of Mechanical Engineers, Nov., 1906.

**Convention of the Association of Superintendents of Bridges and Buildings.** 1,200 words. Railway Engineering, Nov., 1906.

**Fills and Tunnels in the Great West.** By C. L. Thomas. Description of some of the fills and tunnels in the west. 11 illustrations. 900 words. The Contractor, Nov. 15, 1906.

**Form of Contract for Completion of Panama Canal.** 4,000 words. Engineering World, Nov. 16, 1906.

**The Industry and Engineering of Reinforced Concrete, Evolution and Development; Modern Practice.** Article VI. 5 illustrations. 1,400 words. Engineering World, Nov. 16, 1906.

**Car Cleaning.** Paper read before the New York Railroad Club, by B. P. Flory. 3 illustrations. 8,000 words. Official Proceedings of the New York Railroad Club, Oct., 1906.

**Railway Tunnels at Manhattan Island.** Description of tunnel. 12 illustrations. 2,900 words. Electric Railway Review, Nov. 1906.

**Coal and Ash Handling Machinery.** Description of coal and ash handling machinery. 7 illustrations. 1,000 words. Brownings Industrial Magazine, Nov., 1906.

**Convention of the American Street and Interurban Railway and Affiliated Association.** Report of convention. 4,000 words. Railroad Gazette, Oct. 26, 1906.

**Fundamental Features of Railroad Yards.** 2,400 words. Railway Engineering, Nov., 1906.

**Butterfly Dam at Lockport.** By James E. Montgomery. Description of dam. 3 illustrations. 600 words. The Contractor, Nov. 15, 1906.

**New Hecla Route of the West Penn Railways Company.** Description of new road. 1 illustration. 700 words. Electric Railway Review, Nov., 1906.

**The Truckee Carson Project of the United States Reclamation Service.** 16 illustrations. 4 tables. 11,800 words. Engineering News, Oct. 18, 1906.

**Convention of the American Street Railway and Interurban Railway and Affiliated Association.** Report of convention. Railroad Gazette, Oct. 26, 1906.

**New Concrete Dam at Dayton, Ohio.** Description of dam. 2 illustrations. 600 words. The Contractor, Nov. 1, 1906.

**The Form of Contract for the Completion of the Panama Canal on Which bids are to be Received Dec 12.** 4,900 words. Engineering News, Oct. 18, 1906.

**Union Pacific Spends Millions to Save Ten Miles.** Description of cut off near Omaha, Nebr. 6 illustrations. 1,400 words. The Contractor, Nov. 1, 1906.

**Colossal Railroad Cut Completed.** By J. Mayne, Baltimore. 2 illustrations. 800 words. The Contractor, Nov. 1, 1906.

**Greatest Year of New Railroad Enterprise.** 3,100 words. The Contractor, Nov. 1906.

**Pennsylvania's Improved Cut.** Description of new cut. 2 illustrations. 400 words. Railway Age, Nov. 9, 1906.

**Cost of Reinforced Concrete Subways Built by a Railroad Company.** 1 table. 500 words. Railway Maintenance and Structures, Nov., 1906.

**Progress of Construction on the Florida East Coast Ry., Key West Extension, and the Damage done by the Recent Storm.** By Howard Egleston. 1 map. 2,200 words. Railway Maintenance and Structures, Nov., 1906.

**Annual Convention of the Railway Signal Association, Washington, D. C.** Report of convention. 2,100 words. Railway Maintenance and Structures, Nov., 1906.

**Our Present Weights and Measures and the Metric System.** By Henry R. Towne. An argument for a Technical Commission. 12,900 words. Proceedings of the American Society of Mechanical Engineers, Nov., 1906.

**Annual Convention of the Association of Superintendents of Bridges and Buildings.** Report of convention. 6,000 words. Railway Maintenance and Structures, Nov., 1906.

**Proceedings of the American Street and Interurban Railway Association at the Columbus Convention.** Report of convention. 13,500 words. Street Railway Journal, Oct. 27, 1906.

**Tunneling Shield.** Description of shield. 1 illustration. 400 words. Technical World Magazine, Nov., 1906.

**The Brighton Beach Improvement of the Brooklyn Rapid Transit R. R.** By Fletcher Hamilton Burke. 1 illustration. 2,100 words. Railway Maintenance and Structures, Nov., 1906.

**Repairs to Steel Freight Cars and Development of Steel Passenger Cars.** By J. F. McEnulty. Paper read before the New England Railroad Club. 19 illustrations. 8,400 words. New England Railroad Club, Oct. 9, 1906.

**The Pennsylvania Tunnels Across Manhattan Island.** Description of tunnel. 9 illustrations. 1,800 words. The Railroad Gazette, Nov. 2, 1906.

**Concrete Piles in Power House and Foundation Work.** 800 words. Street Railway Review, Nov. 10, 1906.

**Electric Power vs. Steam Power.** A paper by E. W. Farnham, read before the Western Railway Club. 39 illustrations. 10,800 words. Proceedings of the Western Railway Club, Oct., 1906.

**Wood Preserved by Heat.** Description of a new process of wood preservation. 200 words. Compressed Air, Nov., 1906.

**The Salton Sea Conquered.** Description of work being done at Salton Sea. 1 map. 900 words. Railroad Gazette, Nov. 9, 1906.

**Electrically Operated Points and Signals at Didcot.** Description of signals. 20 illustrations. 1,800 words. Engineering, Nov. 2, 1906.

**The Scranton Tunnel of the Lackawanna and Wyoming Valley Railroad.** Description of tunnel. 1,500 words. Compressed Air, Nov., 1906.

**Notes on the Septic Tank Process of Sewage Purification.** By W. R. Butler. 6,500 words. Engineering World, Nov. 9, 1906.

**Notes on Great Tunnels.** Paper by Lewis M. Haupt, read before the Franklin Institute. 3 illustrations. 3,200 words. Compressed Air, Nov., 1906.

**Annual Meeting of Railway Signal Association.** Report of the convention. 5,000 words. Railroad Gazette, Nov. 2, 1906.

**The Necessity of Providing Proper Warehouse Facilities to Relieve the Delays in Unloading Freight Cars.** By A. J. Elliott. 1,600 words. The Engineering Magazine, Nov., 1906.

**The Advantages of a University Education in Connection with Railway Work.** An address delivered before the Canadian Railway Club by Dean Bevey of the McGill University. 3,000 words. Proceedings of the Canadian Railway Club, Oct., 1906.

**The Panama Canal Plans.** 500 words. The Iron Age, Nov. 8, 1906.

**The Slow Sand Filtration Plant for the Water Supply of Washington.** A general description of plant. 7 illustrations. 3,800 words. Engineering News, Nov. 8, 1906.

**Tension Tests of Steel, Angles with Various Type of End Connections.** By Frank P. McKibben. 7 illustrations. 3 tables. 2,100 words. Technology Quarterly, Sept., 1906.

**Railway Signal Association.** A report of convention. 2,100 words. Railway Age, Oct. 26, 1906.

**The Waelschaert Valve Gear as Applied to Locomotives.** A paper read before the New York Railroad Club by C. J. Mellin. 15 illustrations. 5,800 words. Official Proceedings of the New York Railroad Club. Sept. 21, 1906.

**Superintendents of Bridges and Buildings.** Report of convention. 7,000 words. Railway Age, Oct. 26, 1906.

**Pennsylvania's Improved Cuts.** Description of new cut. 2 illustrations. 400 words. Railway Age, Nov. 9, 1906.

**Tunnels Under the Hudson River.** Descriptive of meeting of tunnels under Hudson River. 1 illustration. 500 words. Locomotive Engineering, Nov. 1906.

**The South and Western Railway.** A general description of improvements being made on this road. 8 illustrations. 2,100 words. The Railway Age. Oct. 26, 1905.

**Railway Development in Canada.** By L. J. Payne. 1,800 words. Railway Age. Nov. 2, 1906.

**The Best Safeguard Against Woodstock Disasters.** By A. M. Wellington. 1 illustration. 1,300 words. Engineering News, Nov. 8, 1906.

**Concrete Dam Near Perry, Oklahoma.** Description of dam. 1 illustration. 200 words. Railway Age, Nov. 2, 1906.

**Safe Loading of Commodities in Gondola Cars.** Paper by O. C. Porcher read before the Central Railway Club. 4,000 words. Official Proceedings of the Central Railway Club, Sept. 1906.

**Standard Dwarf Signal for the Harriman Lines.** Description of dwarf signals. 3 illustrations. 700 words. Railway Age, Nov. 9, 1906.

**General Plan for the Construction of the Panama Canal.** 1,400 words. Engineering News, Nov. 8, 1906.

**Practical Wood Preservation.** 1 illustration. 1,100 words. Street Railway Journal, Nov. 3, 1906.

**Reinforced Concrete in the San Francisco Fire. The Johnston Building.** 3 illustrations. 1,600 words. Engineering News, Nov. 8, 1906.

**A New Seaport.** Description of harbor built by the Bangor & Aroostook Railroad. 4 illustrations. 800 words. Railway Age, Nov. 2, 1906.

**Electric Railways in Sparsely Settled Communities.** By E. P. Roberts. 6 tables, 9 curves. 5,000 words. Street Railway Journal, Oct. 20, 1906.

**Changes in the Form of Contract for Completing the Panama Canal.** 1,100 words. Engineering News, Nov. 8, 1906.

**The Technical School and the University. Practical Scientific Training. Its Importance in the Life of the Community.** By Prof. W. H. Burr. 2,000 words. American Machinist, Oct. 25, 1906.

**Railway Electrification.** 1 illustration. 1,200 words. The Engineering Review, Oct. 1906.

**Electrical Railroading.** By Elwood A. Grissinger. Part XI. 1 illustration. 3,000 words. Locomotive Engineer's Journal, Nov. 1906.

**Results of Recent Experience in the Bacterial Treatment of Sewage.** By W. H. Maxwell. Continued from former article. 2,900 words. The Engineering Review, Oct. 1906.

**The Foreman—His Training, Work, and Relation to Railroad Maintenance of Way Organization.** Paper by S. W. Kapp, read before the Engineer's Club of Philadelphia. 5,000 words. Proceedings of The Engineer's Club of Philadelphia, Oct. 1906.

**Some Notes on the Evolution of Electric Transportations.** By Theodore Stebbins. 2,900 words. Street Railway Journal, Oct. 20, 1906.

**The Design and Construction of Mechanical Calculators.** By William J. Gould. 2. 5 illustrations. 1,400 words. The Engineering Review, Oct. 1906.

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Partial list of papers reviewed and the amount for which we will furnish them:

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| American Engineer | $0.25 |
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